SOCIO-ECONOMIC SURVEY
OF
SMALLHOLDER FARMING SYSTEMS IN SOLOMON ISLANDS

HAKAMA
CENTRAL PROVINCE

Agricultural Economics Section
Rural Services Project
Ministry of Agriculture and Lands
Solomon Islands

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Abbreviations and Units of Measure

AES	Agricultural Economics Section (RSP)
CEMA	Commodities Exporting and Marketing Authority
DCRS	Dodo Creek Research Station
MAL	Ministry of Agriculture and Lands
PBME	Project Beneficiary Monitoring and Evaluation (RSP)
RDC	Rural Development Centre (RSP)
RSP	Rural Services Project
km	kilometre = 1,000 m
ha	hectare = 10,000 sq m
m	metre
MT	metric tonne = 1,000 kg
SI$	Solomon Islands Dollar

Acknowledgements

The present report is produced by the staff of the Agricultural Economics Section. The Section was established under the ADB/IDA/IFAD assisted Rural Services Project and is engaged in a two years socio-economic study of smallholder farming systems throughout Solomon Islands, extending from 1987 to 1989.

Many others contributed to the planning of the programme and in its implementation. The study would not have been possible without the support and patience of local people. To them we are grateful and hope that the present report will be in some way of benefit.

We would like to thank members of the Ministry of Agriculture and Lands, in particular the Director of the Rural Services Project and staff, and the Chief Research Officer and staff for their support throughout.

The Statistics Office of the Ministry of Finance has assisted the survey through the generous lending of equipment, canoes and outboards, and in sampling. Thanks are especially due to Richard Harris, Rural Statistician, for his interest in the survey from the outset.

Not least, thanks are extended to the Premier of Central Islands Province, the Provincial Secretary and staff, the Principal Field Officer and members of the agricultural extension service for their support in establishing the survey. It is especially hoped that the present report will find a practical application in development works being undertaken in the Province.

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Chapter: 1
INTRODUCTION

1.1 The Solomon Islands comprise a double chain of islands extending in a north-west south-east direction over 860km of the south-west Pacific between latitudes 5°-12°S and longitudes 155°-170°E. The islands lie directly along a major line of crustal weakness traversing the western Pacific and are the surface expressions of fault-bounded blocks and troughs originating in a zone of geologically intense activity. Warping and block movement are the most significant geomorphic processes responsible for the elevation of land to its present altitude, with marine sediments occuring on some of the highest ranges. Such processes continue spasmodically and raised reefs at various heights occur in many parts of the country, as does intense faulting. Earthquakes are frequent and often initiate land movements in ground already close to shearing point such as saturated soil at the heads of steeply incised gullies, resulting in debris slides among the high ridges (10).

1.2 Solomon Islands lies well within the geographical tropics in an oceanic area where two contrasting trade winds meet, a low-pressure belt of ascending air known as the "inter-tropical convergence zone" (ITCZ). In this zone warm and humid air masses drawn from equatorial regions meet relatively cool and dry sub-tropical air derived from the south-east. From about March to November the islands experience steady, shallow, south-easterly winds. During November and December unsettled weather is likely as the ITCZ moves south over the islands, from which follows steady north-westerly winds. March and April are again unsettled as the ITCZ returns northwards until the south-easterly trade winds become re-established. Cyclonic disturbances may be generated, particularly around December and April when the convergence of the two air streams is strongest. Weather is varied, both temporally and spatially, but is characterised by continally high average temperatures and humitity. Most land areas have a mean annual rainfall of 3,000-5,000mm with variations depending on latitude and orientation to prevailing winds. Temperatures are more uniform, at around 26°C in the lowlands, and never reach extremes which would restrict plant growth. Night time humidity exceeds 90%. This may fall to 60% on clear sunny days, or remain close to saturation point during cyclonic conditions (10).

1.3 The islands are rugged, with a predominance of ridge-valley landscapes and high relief. Undulating rolling landscapes have a limited distribution and extensive fluvial plains are uncommon. Chemical weathering is intense under conditions of continuously high temperature and moisture, however, soil depths are not generally great. Most hill areas have slopes exceeding 12-15° and commonly reach 35-55° among the mountain ridges. Continual soil wash and creep and periodic mass movements effectively keep pace with rock weathering. Only on stable flatter sites do deep profiles develop. The islands for the most part are covered in dense forest, some fire disclimax grassland in parts of Guadalcanal and Florida Islands, and land cleared or cultivated(10).

1.4 The population of Solomon Islands from the 1986 census was 285,176, with an annual growth rate of 3.5%. The land area of 28,370sq km gives a low overall population density of 10 persons per sq km. Settlements are mostly along the coastal margins so that in some parts of the country population densities are high.

1.5 The population distribution of Solomon Islands is summarised in diagram 1.1 and key socio-economic data is presented in table 1.1

1.6 There is considerable variation between land area and population among the provinces. While Western Province accounts for 33% of the national land area it contains only 19% of the population. The West is characterised by low population density compared to provinces such as Central, Malaita and Temotu. Although Temotu contains 5% of the national population it also accounts for only 3% of the national land area, and therefore has a relatively high mean population density. Land area in Solomon Islands is summarised in diagram 1.2.

1.7 While a provincial comparison presents a broad indication of population densities throughout the country, differences within provinces are of significance to agricultural policy. With improvements in communications and administrative links there has been a general migration to the coastal margins where travel and marketing are easier, and where services such as schooling and health are more readily available. The highland interior tends to be sparsely populated in comparison.

Table: 1.1

SOLOMON ISLANDS KEY DATA

Province	Western	Ysabel	Central	Guadalcanal	Honiara
POPULATION					
1986 population	55,250	14,616	18,457	49,831	30,413
annual growth rate	3.0	3.2	2.9	4.3	6.8
% national population	19	5	6	17	11
peri-urban population	3,710	1,901	1,622		30,413
% peri-urban	7	13	9	38	
number of households	7,942	2,362	3,079	8,072	4,317
LAND AREA					
land area (sq km)	9,312	4,136	1,286	5,336	22
% land area	33	15	5	19	0
population density/sq km	6	4	14	9	1,382
1987 PROVINCIAL GOVERNMENT REVENUE AND EXPENDITURE (SI$'000)					
revenue	443	173	191	281	1,033
grants	2,556	634	623	1,247	704
current expenditure	3,504	849	750	1,431	1,561
capital expenditure	200	58	88	192	177
net revenue (negative)	(705)	(100)	(24)	(96)	(2)

Province	Malaita	Makira	Temotu	Total
POPULATION				
1986 population	80,032	21,796	14,781	285,176
annual growth rate	2.7	3.6	2.8	3.5
% national population	28	8	5	100
peri-urban population	3,252	2,588	1,295	44,781
% peri-urban	4	12	9	16
number of households	12,417	3,278	2,375	43,842
LAND AREA				
land area (sq km)	4,225	3,188	865	28,370
% land area	15	11	3	100
population density/sq km	19	7	17	10
1987 PROVINCIAL GOVERNMENT REVENUE AND EXPENDITURE (SI$'000)				
revenue	339	485	160	3,103
grants	1,891	1,095	445	9,195
current expenditure	2,190	1,472	615	12,371
capital expenditure	331	600	0	1,646
net revenue (negative)	(291)	(492)	(10)	(1,719)

Source: Statistics Office Statistical Bulletin 15/87 "Provincial Statistics"
Populationa data revised from Statistics Office Statistical Bulletin 3/88 "Solomon Islands Population Census"

POPULATION COMPOSITION

% by province

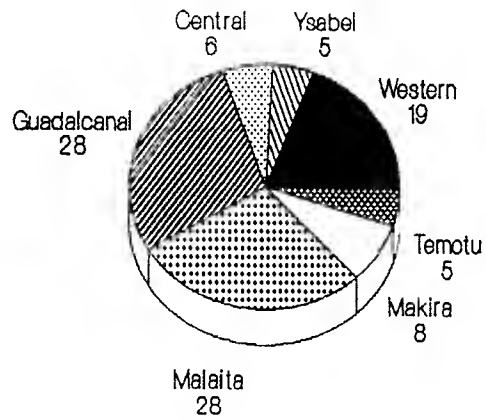


Diagram: 1.1

LAND AREA

% by province

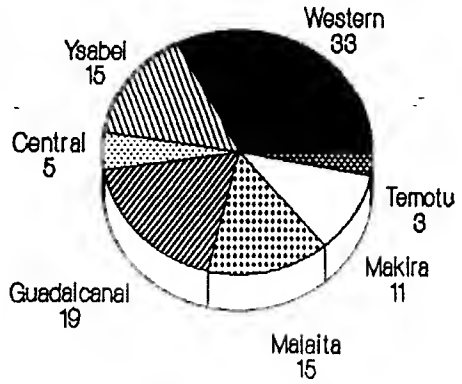


Diagram: 1.2

1.8 Although overall population density is low, in some areas a growing population pressure is causing concern. Traditional farming systems based on forest fallow may be sustained under conditions of low pressure, but run into soil fertility and related problems when fallow periods are reduced and cropping intensified. Conversely, there are sparsely populated areas of agricultural potential where communications and services are poorly developed. The Rural Services Project is developing facilities in areas of high agricultural potential, providing marketing and transport infrastructure, agricultural and training services, and extending the coverage of adaptive research. These provide new opportunities for agricultural development.

1.9 The capacity of government to implement development programmes is to a large extent determined by funds and resources available. Diagram 1.3 summarises provincial government revenue and expenditure in 1987. Nationally there was a deficit of SI$1.7 million arising through over expenditure in all provinces. Provincial finance is characterised by a low revenue earning capacity, being nationally about one third of the level of central government grants. Revenue and grants are expended almost entirely on basic operating costs, although these remain severely constrained and under-funded. There are little or no funds for development, and investment amounted to only 12% of total expenditure in 1987.

1.10 Agriculture accounted for 42% of export earnings in 1985 [11], although this has dropped from the much higher level of 87% in 1960. It is the major employment activity in the country and the source of livelihood for the majority of the population. In terms of human welfare and economic development, agriculture remains high among national priorities.

1.11 Despite various studies undertaken in the past, there is little hard socio-economic data on smallholder farming systems which would assist agricultural policy makers, trainers, extension workers and researchers in the planning, implementation and evaluation of development activities. A national sample survey of agriculture was conducted in 1974-75 [5], but these data are are no longer able to satisfy information requirements.

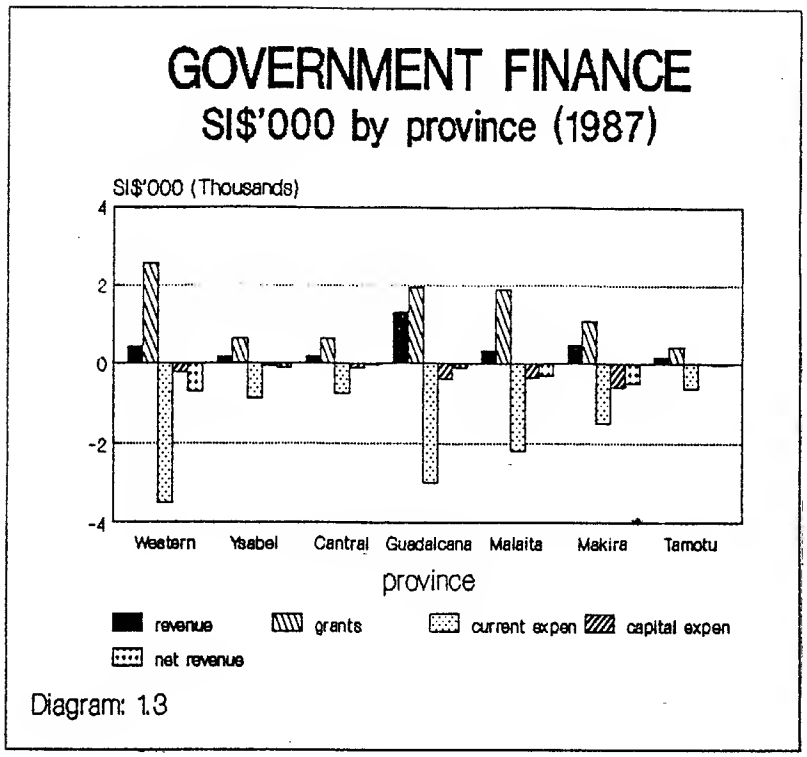


Diagram: 1.3

1.12 The Agricultural Economics Section (AES) was established under the Rural Services Project (RSP) inter alia in order to generate statistical information on smallholder production systems for the quantification of constraints to agricultural development and the devising of appropriate agricultural research programmes. The present study is part of a national survey programme to generate detailed base-line data on smallholder farming systems.

1.13 Since September 1987 AES has conducted a series of farming systems surveys in selected sites throughout the country, such as in the immediate areas of influence of Rural Development Centres or in other areas of special agricultural interest. It is intended that the findings of the survey will find application in the evaluation of development activities, and will assist in the assessment of changes taking place in Solomon Islands agriculture and the formulation of development strategies. The background and justification for the survey programme are documented in the AES Inception Report of 1987 [20]. Methodologies are described in the Agricultural Economics Field Survey Manual [21] and related documents produced by AES.

1.14 The Hakama survey was conducted in September and October 1987 and covered a sample of 56 rural households within the immediate area of influence of the Rural Development Centre. Two stage systematic random sampling was guided by the Statistics Office based on equal probability of household selection, with accessibility taken into account in the definition of the sample frame. Villages were listed from the 1986 population census, and selected by systematic random sampling. A pre-determined number of households within each village (or cluster of small villages) were then selected by simple random sampling. Maps of the survey area are presented in diagrams 1.4 and 1.5.

1.15 The survey is designed to investigate the structure and dynamics of smallholder crop and management systems. Of particular importance in the socio-economics of smallholder agriculture is the allocation of labour, since few cash inputs are applied and little wage labour is employed.

1.16 All cultivated areas, including cropped and cleared land, are measured by tape and compass to an error tolerance of 5%. Crop areas are computed and checked in the field by programmable calculator. Data are processed in "dBASE III Plus" databases and analysed through "SPSS/PC+". Raw output is transferred to "Lotus 123 vr 2" spreadsheets for tabulation and secondary processing. Text tables are incorporated into "Wordstar Professional r 4" and graphics are edited in "Harvard Presentation Graphics".

1.17 Data processing and the presentation of results has been made possible by the generosity of the Government of New Zealand through its Miscellaneous Technical Assistance Programme. This has overcome a primary constraint to work of this kind in the Ministry of Agriculture and Lands through the provision of computing hardware.

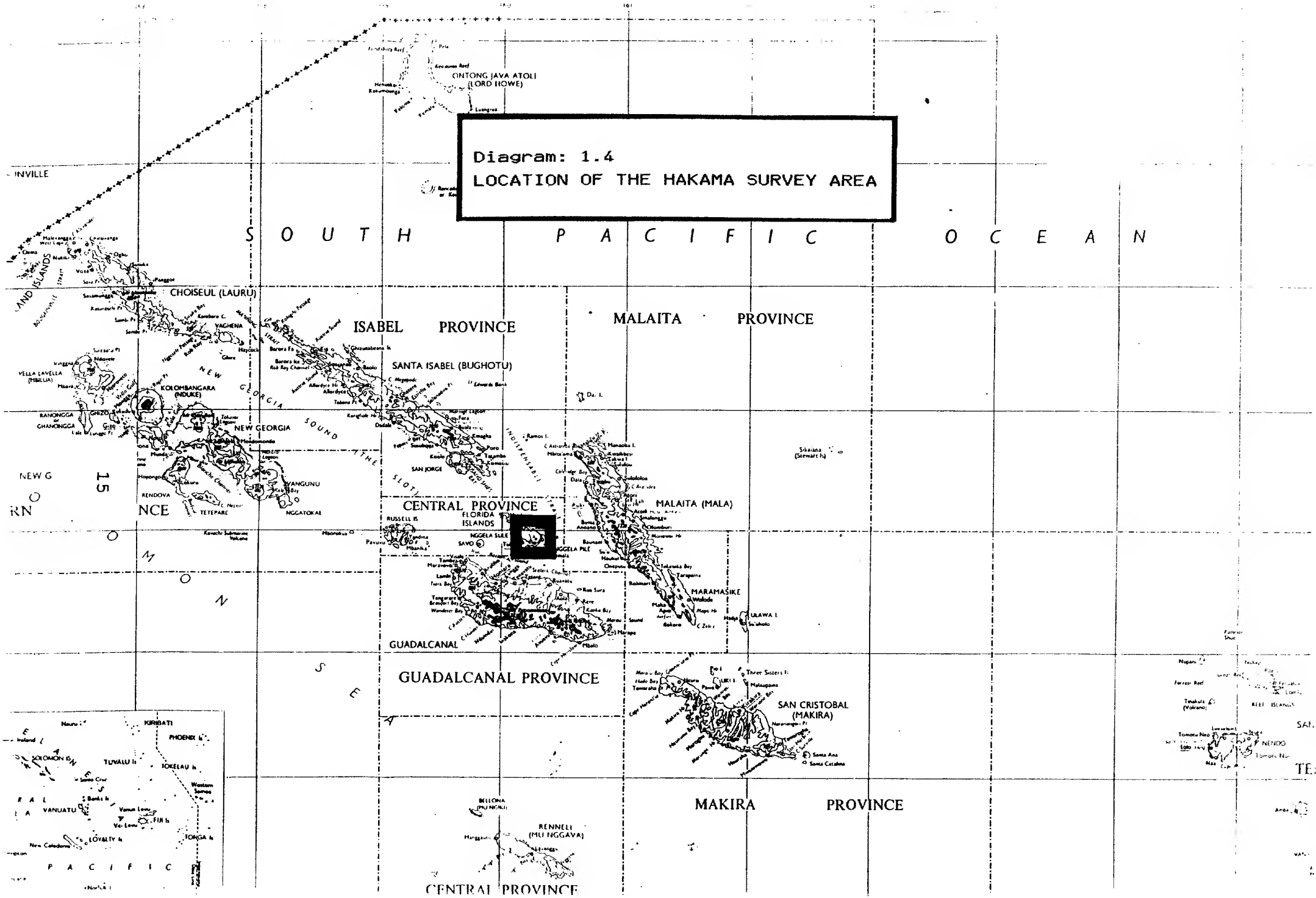
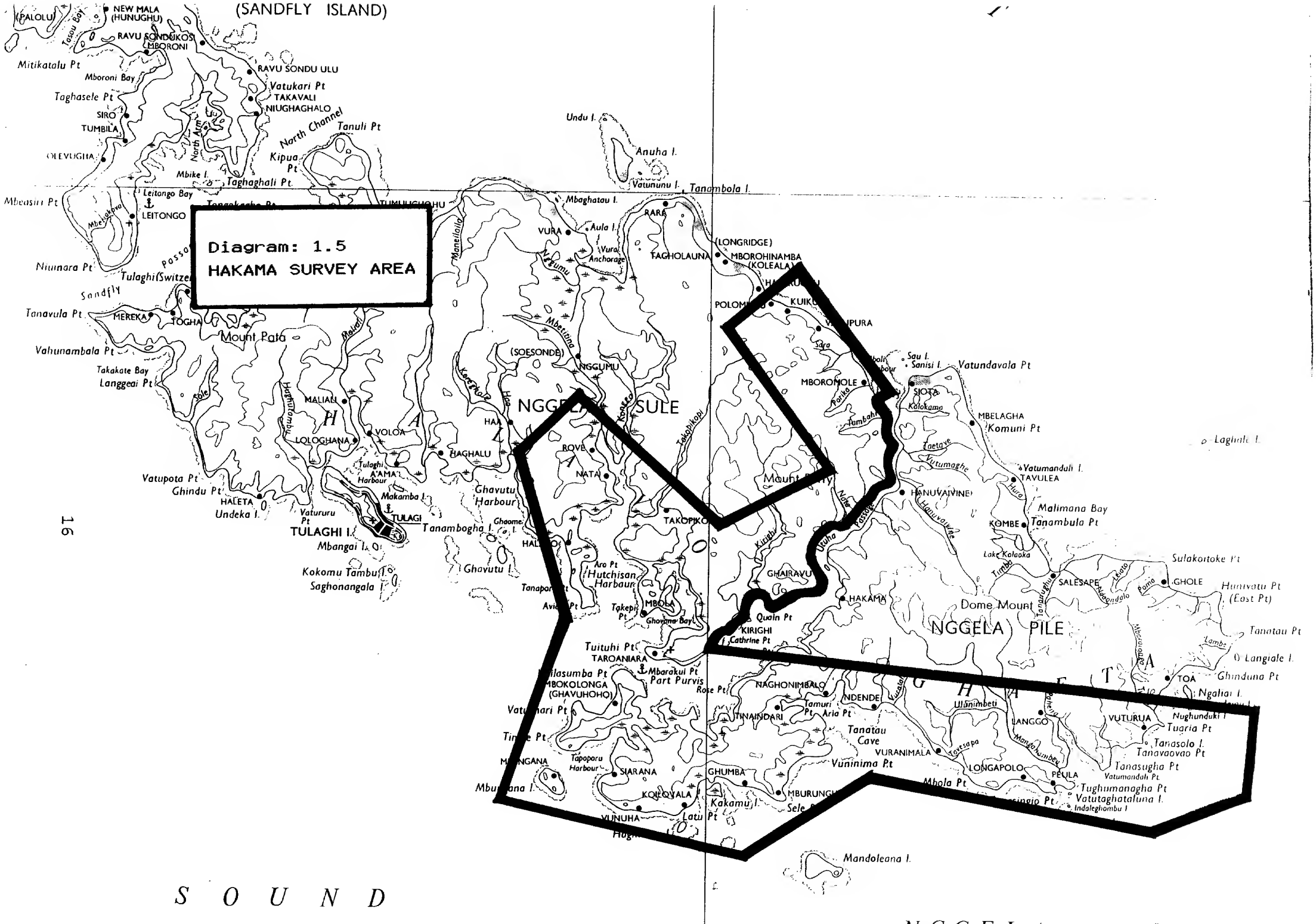


Diagram: 1.4
LOCATION OF THE HAKAMA SURVEY AREA
SOUTH PACIFIC OCEAN
ONTONG JAVA ATOLL (LORD HOWE)
CHOISEUL (LAURU)
ISABEL PROVINCE
MALAITA PROVINCE
SANTA ISABEL (BUGHOTU)
KOLOMBANGARA (NDUKE)
NEW GEORGIA
NEW GEORGIA SOUND
CENTRAL PROVINCE
FLORIDA ISLANDS
MALAITA (MALA)
MARAMASIKE
GUADALCANAL
GUADALCANAL PROVINCE
SAN CRISTOBAL (MAKIRA)
MAKIRA PROVINCE
RENNELL (MU NGGAVA)
CENTRAL PROVINCE
KIRIBATI
PHOENIX Is
SOLOMON Is
TUVALU Is
TOKELAU Is
VANUATU
FIJI Is
TONGA Is
LOYALTY Is
PACIFIC


(SANDFLY ISLAND)
Diagram: 1.5
HAKAMA SURVEY AREA
(PALOLU)
NEW MALA (HUNUGHU)
RAVU SONDUKOS MBORONI
RAVU SONDU ULU
Mitikatalu Pt
Mboroni Bay
Vatukari Pt
TAKAVALI
NIUGHAGHALO
Taghasele Pt
SIRO
TUMBILA
OLEVUGHA
North Arm
North Channel
Tanuli Pt
Kipua Pt
Mbike I.
Taghaghali Pt
Undu I.
Anuha I.
Vatununu I.
Tanambola I.
Mbeasiri Pt
Leitongo Bay
LEITONGO
Mbeasipa
Niumara Pt
Tulaghi
Switzer
Passo
Sandfly
Tanavula Pt
MEREKA
TOGHA
Mount Pata
Vahunambala Pt
Takakate Bay
Langgeai Pt
Mbaghatau I.
VURA
Aula I.
Vura Anchorage
RARA
TAGHOLAUNA
(LONGRIDGE)
MBOROHINAMBA (KOLEALA)
Mbetilina
(SOESONDE)
NGGUMU
Kaeikola
Hee
Mandi
Sole
Hunutambi
MALIALI
VOLOA
LOLOGHANA
HAGHALU
ROVE
NATA
Takopiko
Takapikopi
Kokeka
Tulaghi A'AMA Harbour
Makamba I.
TULAGI
Tanambogha I.
Ghavutu Harbour
Ghaome I.
Vatupota Pt
Ghindu Pt
HALETA
Undeka I.
Vatururu Pt
TULAGHI I.
Mbangai I.
Kokomu Tambuli
Saghonangala I.
Ghavutu I.
Aro Pt
Hutchisan Harbour
Tanapora Pt
Avia Pt
Takepi Pt
MBOLA
Ghoama Bay
Tuituhi Pt
TAROANIARA
Mbarakui Pt
Part Purvis
Vilasumba Pt
MBOKOLONGA (GHAVUHOHO)
Vatu[illegible]ari Pt
Tin[illegible]e Pt
[illegible]NGANA
Tapoporu Harbour
SIARANA
Mbu[illegible]ana I.
KOLOVALA
VUNUHA
Hug[illegible]
Latu Pt
Kakamu I.
GHUMBA
MBURUNGI
Sele
Vuninima Pt
Mbola Pt
Indoleghombu I
Tughumanagha Pt
Vatutaghataluna I.
Tanasugha Pt
Vatumanduli Pt
Tanasolo I.
Tanavaovao Pt
Nughunduki I
Tugaria Pt
VUTURUA
PEULA
LONGAPOLO
Mangolumbes
Tavesapa
VURANIMALA
Tanatau Cave
LANGGO
TINAINDARI
Tamuri Pt
Aria Pt
NDENDE
NAGHONIMBALO
Rose Pt
Ulisnimbeti
Tuvala
Quain Pt
KIRIGHI
Cathrine Pt
HAKAMA
GHAIRAVU
Dome Mount
NGGELA PILE
Takepiko
Kirighi
Utuha
Nore
Tasiole
Hanuvaivine
HANUVAIVINE
Mount Ely
Taetave
Vutumaghe
Hura
Vatumanduli I.
TAVULEA
Malimana Bay
Tanambula Pt
KOMBE
Lake Kolaoka
Timbo
Tanadughu
SALESAPE
Nadeandolo
Lagoo
Pomo
GHOLE
Sulakoitoke Pt
Hunivatu Pt (East Pt)
Tanatau Pt
Langiale I.
Ghinduna Pt
Ngaliai I.
TOA
Lambi
Abiaroaro
Mbiaroaro
Laghale I.
MBELAGHA
Komuni Pt
Vatundavala Pt
Sau I.
Sanisi I.
SIOSA
Kolokama
MBOROHOLE
Parita
Tambahi
Sara
KUIKU
POLOM
IPURA
Mandoleana I.
SOUND
NGGELA

Chapter: 2
SUMMARY AND MAIN FINDINGS

Household Composition

2.1 The mean household size in the survey area is 5.74, comprised of an approximate balance of 2.89 males to 2.85 females.

2.2 The available labour composition of rural households in the survey area is **1.56male:1.73female**, or **47%** male to **53%** female out of a total of 3.29 adult equivalent labour units per household.

Income Earning Activities

2.3 Rural income earning activities in terms of frequency of activity, but not necessarily income contribution, are predominantly "food crop" sales. **45%** of households are engaged in food crop marketing compared with **20%** of households in the marketing of copra and **5%** cocoa. Fishing is important, with **34%** of households earning income from the sale of fish, **13%** from the sale of crabs, and **9%** from the sale of shellfish.

2.4 The rural economy is diverse, with a wide range of income earning opportunities. **25%** of households are engaged in some form of business enterprise. **10%** are members of production or marketing cooperatives, and **13%** have a skilled trade or profession. No logging or mining activities are conducted by households in the survey.

Extension and Mass Media

2.5 **46%** of households listen to agricultural programmes on the radio, although only **12%** listen regularly. Written materials may be more appropriate extension media than has been supposed since it is found that **79%** of households have at least one member with some reading and writing ability. The survey does not, however, verify this result or investigate the quality of such skills.

2.6 Given severe funding and other constraints experienced, it is unsurprising that the intensity of extension services is low. 46% of households have never been visited by extension workers, whether government or non-government, and there are few cases of regular visits. Some use is made of simple extension methods such as village meetings but this could be developed further. There is no evidence of extension bias although there is some targeting of programmes towards influential farmers.

Livestock

2.7 Livestock, predominantly pigs and chickens, are an important component of smallholder farming systems. **46%** of households own pigs with a mean herd size of 3.81 among owners. Chickens are kept by **46%** of households with a mean flock size of 12.81 among owners. Ducks are owned by **5%** of households with a mean flock size of 2.67 among owners.

2.8 **2%** of households own cattle with a mean herd size of **9.00** among owners.

2.9 There is one occurence of bee keeping, but no butterfly or crocodile farming.

Holding Size Distribution

2.10 The mean holding size in terms of area cultivated is **1.312ha** but the holding size distribution is skewed. **55%** of farmers have holdings of less than **0.5ha** and **75%** of farmers have holdings less than the mean holding size. The median holding size of **0.428ha** indicates that inequalities in the size of holdings should be taken into account in development programmes, since the mean in itself is liable to be misleading.

2.11 Inequality in holding size can to a large extent be explained by whether or not farmers have tree crops, notably coconuts. Such holdings tend to be large, with a mean size of **3.073ha** but they represent only **35%** of farmers. Conversely non-tree cropping farmers have a mean holding size of **0.383ha** and represent **65%** of sampled farmers.

2.12 All farmers grow traditional subsistence or food crops, where the area cultivated to these crops is relatively constant among all farmers. The overall mean food crop area is **0.404ha** and the mean tree crop area is **2.627ha**.

Labour Density

2.13 The mean labour availability among 55 households is 3.27 adult equivalent labour units per household, resulting in a mean labour density of **2.49** labour units per hectare. There is no apparent relationship between labour availability and holding size. Consequently labour density per unit area falls rapidly from 19.12 labour units per hectare on holdings of less than 0.25ha in size to **0.10** labour units per hectare on holdings greater than 10ha in size. On non-tree cropping holdings the mean labour density is 8.12 labour units per hectare compared with 1.17 labour units per hectare on tree-crop holdings. This suggests that labour is unlikely to be limiting on the majority of small holdings, but may be on larger holdings and in particular on tree crops.

Cropping Patterns

2.14 The average holding size is 1.31ha, however, a distinction is made between farmers with tree crops and those with no tree crops. Of households with tree crops the mean holding size is **3.09ha**, of which **2.62ha** is under tree crops and **0.46ha** is food crops. In contrast non-tree crop farmers have a mean holding size of **0.37ha** under food crops. Smallholder cropping patterns are complex and diverse, with 9 dominant crops recorded and a total of 69 distinct mixtures.

Coconuts and Cocoa

2.15 **35%** of sampled farmers have coconuts and **11%** grow cocoa. Most farmers with cocoa also grow coconuts, since **9%** of farmers have both coconuts and cocoa (30).

2.16 Almost all coconuts are local tall. **10%** are less than 8 years of age, **17%** are aged 9 - 16 years, and **59%** are aged 17 - 40 years. **14%** are over 40 years of age.

2.17 **97%** of coconut plantings are pure stand and **3%** are planted with cocoa. On pure stand coconuts **3%** were undercropped, with food crops planted among new stands. **3%** are burnt, **18%**

brushed to ground level, 12% brushed to shoulder height and 65% have reverted to secondary bush.

2.18 69% of cocoa plantings are less than three years of age, 28% are 3 to 5 years, and 3% are six or more years of age. 83% of cocoa shade is planted or natural and 17% is under coconuts.

Fallow

2.19 Fallow in Solomon Islands farming systems is necessary for the maintenance of soil fertility, particularly for the replenishment of potassium in ash following burning. Shifting cultivation has other valuable characteristics, not least its phytosanitary qualities. The fallow period is an indicator of land pressure, and possible fertility and pest problems associated with intensive cultivation. On gardens where it is known, there is a fallow period of 9.6 years, but 62% of gardens have a fallow longer than memory. Root crops are typically grown over 3 to 4 harvests before reverting to fallow.

2.20 84% of all gardens have a fallow of primary or secondary forest, with a further 9% under dense shrubby thicket. Such long fallow regeneration is found over 65% of the cropped area. Present fallow periods are able to maintain productivity in smallholder farming systems under low population pressure, but such extensive land use may not be sustainable in the longer term.

2.21 19% of the food garden area was cut from primary forest compared with 15% of the tree crop area. Overall 15% of the cultivated area has expanded into primary forest, with 45% within secondary forest.

Landform

2.22 70% of coconut gardens representing 42% of coconut area are on beach sites or lowland plains. 30% of coconut gardens representing 68% of the coconut area are on upland sites, mainly on level or gently sloping sites.

2.23 In contrast the majority of food crop gardens are on upland sites. 88% of food crop gardens representing 87% of the food garden area are on upland, mostly moderately or steeply sloping, sites. 12% of gardens representing 13% of the food garden area are on lowland sites.

2.24 The mean slope is 17 degrees. 25% of all plots, representing 33% of the total cultivated area are on sites of less than 5 degrees slope. The mean slope of coconuts is 4 degrees and cocoa is planted on level sites. The mean slope of sweet potato plots is 14 degrees, with 61% of plots representing 66% of the sweet potato area on sites of less than 10 degrees of slope. Yam plots tend to be on steeper sites, with a mean slope of 29 degrees, but in area terms yams are mostly on sites of 5 to 10 degrees. The mean slope of pana is 23 degrees, with 53% of pana plots on slopes greater than 20 degrees.

2.25 There is little sign of erosion as a result of agriculture and no conservation measures are practiced other than one occurrence of contour cultivation in a food garden.

2.26 The overall mean distance of gardens from households is .264 hours, with a maximum recorded distance of 1.30 hours. There is no apparent relationship between garden size, crop type, and distance of garden from the household.

Adverse Factors Affecting Production

2.27 62% of gardens, but representing only 28% of the cultivated area, have no apparent site limitations. Poor soil is regarded as a constraint on 13% of gardens (11% of area); pests and disease are a problem on 27% of gardens (47% of area); weeds and related factors are a problem on 30% of gardens and affect 54% of the cultivated area.

2.28 The dominant problem is weeds on large coconut plantings, and pest and disease problems are extensive.

Crop Yields

2.29 Production data from the farming systems survey are not available and so indicative yields derived from secondary sources are summarised in table 2.1.

Table: 2.1
SMALLHOLDER CROP YIELDS

crop	condition	yield kg/ha
coconut	copra equivalent	800
cocoa	dry beans	600
sweet potato	> 8 years fallow	8,000
	4 - 8 years fallow	5,000
	< 4 years fallow	3,500
taro		5,000
yam	> 8 years fallow	10,000
	4 - 8 years fallow	6,000
	< 4 years fallow	4,500
pana	> 8 years fallow	10,000
	4 - 8 years fallow	6,000
	< 4 years fallow	4,500
cassava		10,000
maize		1,800
groundnuts		600

Text source: Table 14.5

Crop Production

2.30 Daily crop production has been measured by the Statistics Office in the Rural Services "Project Beneficiary Monitoring and Evaluation" exercise, and is summarised in table 2.2.

Table: 2.2
SMALLHOLDER PRODUCTION

Average daily production from entire household (kg):

commodity	Province and Site						
	Ysabel	Central	Guadalcanal	Malaita	Makira	Temotu	Average
	Susubona	Hakama	Marau Sound	Afio	NW Peninsula	Lata	
sweet potato	8.00	2.67	6.68	3.79	4.09	4.19	4.90
cassava	1.26	0.98	2.15	0.35	0.63	0.04	0.90
yam	0.68	1.68	0.71	2.25	0.65	0.90	1.14
pana	0.58	4.60	0.32	0.06	0.34	0.12	1.00
taro	0.71	0.32	0.45	1.60	1.37	1.15	0.93
breadfruit	0.01		0.03	0.01		0.11	0.03
banana	0.55	0.56	1.85	0.83	2.06	0.28	1.02
sub-total	11.79	10.80	12.20	8.90	9.13	6.78	9.93
coconut	0.44	0.49	3.55	1.41	2.54	0.43	1.48
cabbage	0.24	0.26	0.40	0.75	0.71	0.32	0.45
other veg	0.29	0.12	0.24	0.05	0.37	0.08	0.19
other fruit	0.91	0.31	2.01	0.89	1.90	0.41	1.07
fresh meat			0.01		0.01	0.03	0.01
fresh fish	0.69	0.40	0.57	0.32	0.25	0.12	0.39
crab/shellfish	0.58	0.20	0.13	0.23	0.02	0.05	0.20
milk/eggs	0.01				0.00		0.00
betel nut	0.09	0.08		0.16	0.06	0.11	0.08
local tobacco		0.03			0.01	0.01	0.01
Based on observations from the following number of "household days":	1,200	960	480	840	1,200	720	900

Source: Statistics Office PBME unpublished results - courtesy of Statistics Office.
Text source: Table 15.1

2.31 On average there are **9.93kg** of staple crops produced daily, the crop composition varying according to area and season. With a national mean household size of **6.50** this would provide each man, woman and child with approximately **1.5kg** of staple root crop per day.

Labour

2.32 The dominant constraint expressed by farmers is on tree crops, where **74%** of the area has a shortage of labour and **29%** is affected by a shortage of inputs or cash. In contrast only **19%** of the food garden area is affected by a shortage of labour and **3%** from a shortage of inputs or cash. Distance to gardens is only a minor concern.

2.33 Labour expenditure on the average holding is summarised in table 2.3 - presented firstly by crop (aggregating all operations), and secondly by operation (aggregating all crops).

Table: 2.3
LABOUR SUMMARY

	⟨------ work days per year -----⟩ ⟨----- per holding -----⟩				per ha	⟨- % contribution -⟩			labour cost
i) By Crop	men	women	paid	total	average	men	women	paid	(SI$)
Cleared Land	1			1					
Coconut	224	36	15	275	330	81	13	5	14
Cocoa	14	6	2	22	332	64	27	9	1
Pineapple					15				
Sweet Potato	28	69		97	906	29	71		1
Yam	7	20		27	561	26	74		
Pana	50	150		200	953	25	75		1
Cassava	1	1		2	361	50	50		
All Crops	325	282	17	624		52	45	3	17
ii) By Operation									
Land Clearance	79	38	11	128		62	30	9	9
Cultivation	104	4	1	109		95	4	1	1
Planting	25	36	1	62		40	58	2	1
Tree Crops Establishment	25	1	1	27		93	4	4	1
Tree Crops Maintenance	21		1	22		95		5	1
First Weeding	18	39	1	58		31	67	2	2
Second Weeding	16	23	1	40		40	58	3	2
Third Weeding	18	34		52		35	65		
Harvesting	19	107		126		15	85		
All Operations	325	282	17	624		52	45	3	17
Available labour units	:1.56	1.73							
Days per unit labour	: 208	163	17						

Text source: Table 16.3

2.34 Overall there are 624 work days required per year on the average holding, of which 325 are provided by men, 282 by women and 17 by hired labour at an annual cost of SI$17. The average adult man in the household spends 208 days working on the holding and the average adult woman spends 163 days, with an additional 17 days of hired labour.

2.35 Coconuts account for **44%** of the holding labour budget with a requirement of 275 work days per year. Root crops require a further 327 work days per year, accounting for **52%** of the labour budget. Men provide **81%** of the labour on coconuts, **27%** of the labour on root crops and are mostly responsible for the clearing of land, cultivation and the maintenance of tree crops. Women provide **13%** of labour on coconuts, **75%** of the labour on root crops and are mostly responsible for planting, weeding and harvesting. Overall men contribute **52%** of labour, women provide **45%** and **3%** is accounted for by hired labour.

Cash Crop Processing

2.36 While **35%** of farmers grow coconuts only **20%** earn income from the sale of copra. The labour input in the manufacture of copra is **93%** family and **7%** hired, at an annual cost of **SI$4.2**. Copra production is labour intensive, requiring on average **217** work days per annum to produce **1,789kg** copra, or one work day per **9kg** copra produced. At the prevailing price of 33 cents per kilo this offers a net return of **SI$2.78** per household work day. The net mean annual income from copra is **SI$559**.

2.37 **4%** of sampled farmers (two farmers) process cocoa with an annual production of **50kg** dry beans. At a household labour input of **484** work days this represents a production of **0.1kg** per work day. The number of hours spent per work day is, however, low so the budget appears unfavourable when computed on a daily basis. At the prevailing price of SI$1.80 per kilo the annual income is **SI$89**, or **SI$0.18** per work day.

Marketing

2.38 There is no apparent association between price and the volume of crop sales due to the effects of a prolongued drought on supply and prices. There is a certain amount of cross-subsidisation in the marketing of crops, where it would otherwise be uneconomic to sell small volumes or low value crops. There are numerous marketing constraints identified, notably transport.

Chapter: 3
HOUSEHOLD COMPOSITION

3.1 The analysis of household composition in the farming systems survey is to set production and management information in a social context and to establish labour availability. New demographic data are becoming available from the 1986 census and these provide background to survey results. Table 3.1 summarises some early results of the census[1].

Table: 3.1
POPULATION CHARACTERISTICS
(from the 1986 census)

Province	Western	Ysabel	Central	Guadal	Honiara	Malaita	Makira	Temotu	Total
1986 population	55,250	14,616	18,457	49,831	30,413	80,032	21,796	14,781	285,176
annual growth rate	3.0	3.2	2.9	4.3	6.8	2.7	3.6	2.8	3.5
% national population	19	5	6	17	11	28	8	5	100
peri-urban population	3,710	1,901	1,622		30,413	3,252	2,588	1,295	44,781
% peri-urban	7	13	9	38		4	12	9	16
males	29,202	7,329	9,850	26,251	17,293	39,605	11,174	7,268	147,972
females	26,048	7,287	8,607	23,580	13,120	40,427	10,622	7,513	137,204
sex-ratio	112	101	114	111	132	98	105	97	108
number of households	7,942	2,362	3,079	8,072	4,317	12,417	3,278	2,375	43,842
household size	6.96	6.19	5.99	6.17	7.04	6.45	6.65	6.22	6.50
Age composition (%)									
0 - 14	46.4	48.8	45.7	46.8	39.2	50.2	50.7	49.6	47.3
15 - 29	27.2	22	26	27.2	35.7	21.7	23.3	23.3	25.8
30 - 44	13.5	13.9	14.4	14	17.1	13.2	13.1	13.3	13.9
45 - 59	8	8.5	8.2	7.3	5.8	9.1	8.2	8.5	8.1
60 +	4.9	6.7	5.7	4.6	2.1	5.7	4.6	5.5	4.9

Source: Statistics Office Statistical Bulletin 3/88

3.2 In November 1986 the population of Solomon Islands was 285,176 with an annual growth rate of 3.5%. The national mean household size was 6.5, resulting in a total of 43,842 households, of which at least 84% are rural. Guadalcanal, Malaita and Western Provinces account for 77% of the national population.

3.3 The age composition of the Solomon Islands population is young with a wide based, tapering population pyramid. The "dependency ratio" (the number of persons under 15 years and over 60 years of age per 100 persons aged 15 to 59 years) is 109[2].

3.4 The total fertility rate is 6.4 children per woman at the end of her child bearing age. The life expectancy at birth among males is 59.9 years, and among females is 61.4 years. Male infant mortality is 40 per thousand live births compared with a female infant mortality of 36 per thousand live births[2].

3.5 In the census 40,046 persons attended school during 1986, although some disruption was caused by Cyclone Namu. Among all persons aged 5 years and over not attending school in 1986, 51% had no education. Primary school attendance spans a wide age range, but 20% of age group 10 to 24 never attended school.

3.6 94.2% of the Solomon Islands population is Melanesian, 3.7% Polynesian and 2.1% other ethnic groups, but mainly Kiribati. 17% of the census population were residing in a province other than that of their birth, indicating a considerable level of internal migration. Onward movement is particularly strong from Malaita, resulting in net out-movement. This is true for provinces other than Central and Guadalcanal which experience a net in-movement. All provinces showed a net movement to Honiara.

3.7 Household composition results from the farming systems survey are summarised in table 3.2. Age categories are chosen to provide approximate conversion into "available labour units". The membership of a household often includes relatives, and less commonly non-relatives (these are both referred to as "relatives" in the table), and both family and non-family members define the "de facto" household size. This is the actual number of people residing in the household and is illustrated in diagram 3.1. A second measure of household composition is the number of immediate family members (father, mother, sons and daughters) either living at home or living away. This is known as the "de jure" family size.

3.8 In the survey area the average family size is 5.93. With 11% of family members living away from home, a household has on average 5.74 members, of which 5.27 are immediate family and the remainder relatives or others residing in the household. Those living away are mostly male, in the economically active age group 16 - 55. Of 3.01 male family members 2.58 live at home, representing a net onward movement of 17% among male family members. This is not compensated for by non-family male household members, since there are only 2.89 males in the household.

Table: 3.2
HOUSEHOLD COMPOSITION
(from the farming systems survey)

Mean Number of Household Members:

MALE						FEMALE				
living at HOME			AWAY	AGE GROUP		living at HOME			AWAY	
Head	Family	Relative	Family			Head	Family	Relative	Family	
0.27	0.04	0.04	0.02	> 55		0.05	0.21	0.02		
0.54	0.45	0.09	0.34	16 - 55		0.16	1.11	0.07	0.23	
	0.80	0.13	0.07	6 - 15			0.71	0.02		
	0.39	0.05		2 - 5			0.41	0.05		
	0.09			0 - 1			0.04			total
Category total: 0.81	1.77	0.31	0.43			0.21	2.48	0.16	0.23	6.40
Family at home:	2.58						2.69			5.27
De Facto total:		2.89						2.85		5.74
De Jure total :			3.01						2.92	5.93

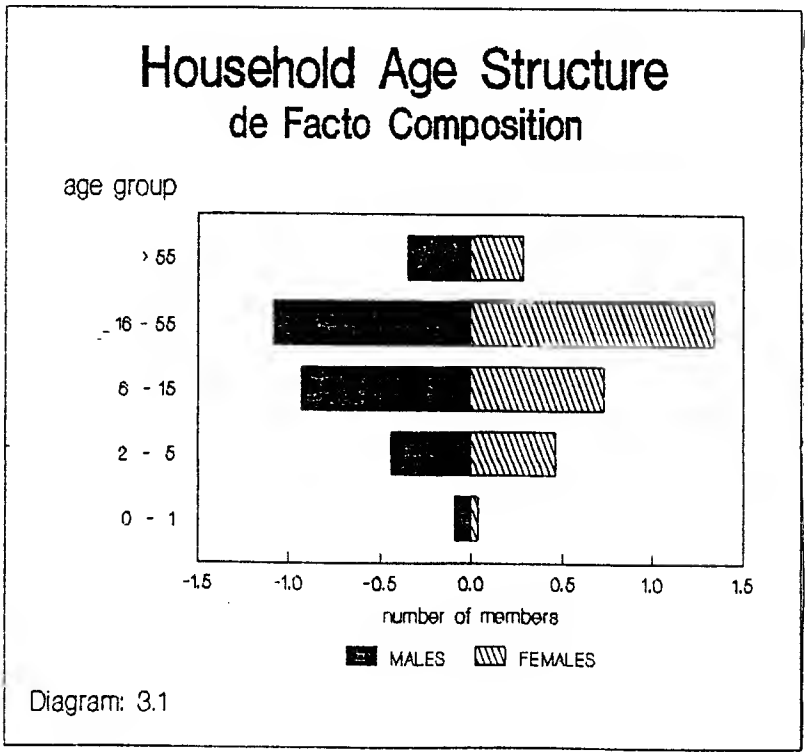


Diagram: 3.1

3.9 Of 2.93 female family members 2.69 live at home, representing a 9% onward movement. As with males, this is not compensated for by additional non-family female members living in the household since there are altogether 2.85 female members of the household.

3.10 There is then a 17% net out movement of males and a 9% net outward movement of females, predominantly in the economically active age group. This results in a household gender composition of 2.85 female household members to 2.98 males, an approximate balance of males and females.

3.11 De facto household composition is converted into "adult equivalent labour units" in table 3.3 according to factors employed by Bathgate[18] (although there are slight differences in age classes between the two studies). An average household of 3.29 labour units is made up of 1.56 male units and 1.73 female units. Due to slight differences in age and numbers, women account for 53% of household available labour compared to 47% from men.

Table: 3.3
HOUSEHOLD LABOUR AVAILABILITY

Mean number of members by age group:

MALES de Jure	MALES de Facto	MALES labour	AGE GROUP	FEMALES de Jure	FEMALES de Facto	FEMALES labour	TOTAL de Jure	TOTAL de Facto	TOTAL labour
0.33	0.35	0.20	> 55	0.26	0.28	0.17	0.59	0.63	0.37
1.33	1.08	1.08	16 - 55	1.50	1.34	1.34	2.83	2.42	2.42
0.87	0.93	0.28	6 - 15	0.71	0.73	0.22	1.58	1.66	0.50
0.39	0.44		2 - 5	0.41	0.46		0.80	0.90	
0.09	0.09		0 - 1	0.04	0.04		0.13	0.13	
Total 3.01	2.89	1.56		2.92	2.85	1.73	5.93	5.74	3.29

Labour availability assumes the following conversion factors:

age class	factor
> 55	0.6
16 - 55	1.0
6 - 15	0.3
0 - 5	0.0

Chapter: 4
INCOME EARNING ACTIVITIES

4.1 2.5% of rural households in the country were enumerated in the 1982 Household Income and Expenditure Survey [3] conducted by the Statistics Office of the Ministry of Finance. Virtually all rural households had food gardens. 39% sold copra and 41% sold garden produce, with an average monthly income from sales of SI$ 56. A summary of income earning activities according to the 1982 survey compared with the 1986 population census is presented in table 4.1.

Table: 4.1
1982 INCOME AND EXPENDITURE SURVEY: SALES

activity	% households earning income	
	1982	1986
copra	39	29
coconut	18	
cocoa	0.38	9
betel nut	1.25	17
other cash crop	12	
garden produce	41	34
cattle		2
pigs		12
poultry		10
fish	24	17
crabs, lobster		4
beche de mer		12
shells	7	
carvings	4	
hand crafts	0.38	4
canoes		3
mats, baskets		10
thatch		4
houses		5
other sales	1.13	

Source: Statistics Office Natioanl Accounts Discussion Document No 2
Statistics Office Bulletin 12/88

4.2 These figures show the importance of garden produce sales as an income earning activity, although the relative magnitude of earnings is not known. Copra is the major cash earning commodity, showing an apparent contraction in the proportion of rural sales. By contrast cocoa sales have expanded.

4.3 In the 1982 survey 27% of rural households had at least one member in paid employment from which the average monthly wage was SI$103. 16% had their own business and 39% of households had a share in a cooperative (although it is stated that this result should be treated with caution). 10% of households held a loan, with an average monthly repayment of SI$87, the majority with the Development Bank of Solomon Islands.

4.4 On average a household spent SI$57 per month on goods and services of which 47%, or SI$27, was on food. Less frequent expenditures amounted to SI$5 per month.

4.5 Reported (cash and non-cash) income was SI$147 compared to monthly expenditures of SI$131. The average cash component of income amounted to SI$86 per month compared with expenditures of SI$74. The excess of 17% in income over expenditure was believed to be due to the underestimation of production costs rather than the true value of rural savings.

4.6 The 1986 census [2] found that 25% of the population aged 14 years and over was working for money (the week before the census enumeration), and about half of those also performed village work such as track clearing and church construction. About 80% of those not engaged in cash employment performed village work.

4.7 35% of males were engaged in cash employment compared with 13% of females. The 1982 Household Income and expenditure survey also states that "generally boys had a better chance of attending school than girls".

4.8 The rural economy is diverse, with a variety of farm and off-farm activities which contribute to household income. Results from the farming systems survey are presented in table 4.2. The table describes the proportion of households undertaking income earning activities in the survey area.

Table: 4.2
INCOME EARNING ACTIVITIES

	(---- % households by activity ---- individual	group	summary of individual activities
Households Earning Income Over the Past Year From:			
COCONUTS			
Coconuts	9	18	++++
Copra	11	20	+++++
Coconuts and Copra	9		++++
Total	29		
COCOA			
Wet beans		2	
Dry Beans	4	5	+
Wet and Dry Beans	2		.
Total	5		
OTHER CROPS			
Food Crops	29	45	+++++++++++++
Other Cash Crops	5	7	++
Food and Cash Crops	2		.
Livestock	2	16	.
Food crops and Livestock	14		+++++++
Cash Crops and Livestock			
Food, Cash Crops and Livesock			
Total	52		
FISHING			
Fish	20	34	+++++++++
Shellfish		9	
Fish and shellfish	2		.
Crabs, etc		13	
Fish and Crabs	5		++
Shellfish and Crabs			
Fish, Shellfish and Crabs	7		+++
Total	34		
LOGGING/MINING			
Logging			
Sawmill			
Logging and Sawmill			
Mining			
Logging and Mining			
Sawmill and Mining			
Logging, Sawmill and Mining ..			
Total			

INCOME EARNING ACTIVITIES (continued)

	⟨---- % households ----⟩ by activity		
	individual	group	summary of individual activities
PROFESSION			
Teacher	2	2	.
Government Employee			
Other Profession			
Total	2		
COOPERATIVE			
Crop Production Cooperative ..			
Marketing Cooperative	2	3	.
Crop and Marketing			
Cooperative Shop	7	8	+++
Crop and Shop			
Marketing and Shop	1		.
Crop, Marketing and Shop			
Total	10		
BUSINESS			
Private shop	9	11	++++
Vehicle Hire			
Shop and Vehicle			
Crafts	14	16	+++++++
Shop and Crafts	2		.
Vehicle and Crafts			
Shop, Vehicle and Crafts			
Total	25		
SKILLED TRADE			
Joiner/housebuilder	2	2	.
Mechanical Trade	2	2	.
Joiner and Mechanical			
Other Skilled Trade	7	7	+++
Joiner and Other			
Mechanical and Other			
Joiner, Mechanical and Other .			
Total	11		

4.9 In the table are two columns, entitled "individual" and "group". Individual activities distinguish between combinations of activities - treating for instance "food crops" (only), "livestock" (only) and both "food crops and livestock" as three distinct activities. The percentages of households for individual activities are additive, and are shown as a "total" for each set of related activities in the table.

4.10 Under group activities - all occurrences of "food crops" and all occurrences of "livestock" are summarised under the two main headings, since "livestock" and "food crops and livestock" are both livestock activities. "Group" activities represent an alternative summary for the data set, and are non additive.

4.11 To the right of table 4.2 is a histogram summary of individual activities. Diagram 4.1 provides a visual summary of grouped activities.

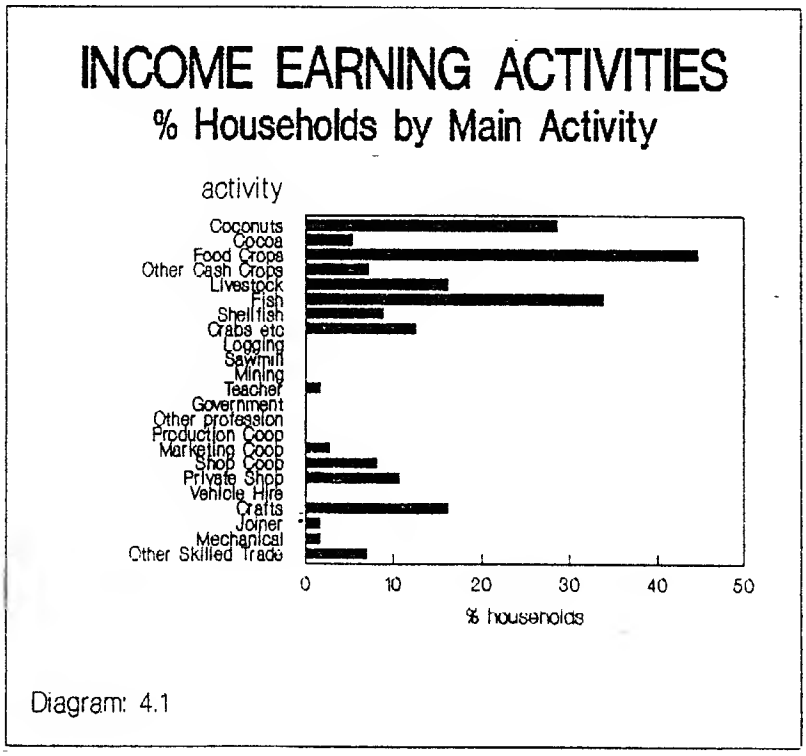


Diagram: 4.1

4.12 Results in table 4.2 are broadly in line with the 1982 Household Income and Expenditure survey and the 1986 Population Census, although all three show wide variations which may be partly attributed to differences in time, scope and scale of coverage.

4.13 In the present study the most frequent income earning activity is the selling of food crops, undertaken by **45%** of households. This is followed by fishing, from which **34%** of households earn income , and **9%** from selling shellfish. **29%** of households in the survey earn income from coconuts and copra, but only **20%** from copra alone. This is lower than 1986 national census estimate of 29% for households selling copra.

4.14 **5%** of households earn income from cocoa. Livestock is an income earning activity for **16%** of households.

4.15 Trade is important. **11%** of survey households earn income from running a private shop and **8%** are associated with cooperative shops. **16%** of households earn income from the sale of crafts. Skilled trades and professions are also income earning activities.

Chapter: 5
EXTENSION AND MASS MEDIA

5.1 Table 5.1 summarises the penetration of mass media and extension in the survey area.

Table: 5.1
EXTENSION AND MASS MEDIA

	% households	summary
i) Households Listening to Agricultural Programmes on the Radio:		
Never listen	54	++++++++++++
Listen weekly	5	+
" monthly	7	+
" occasionally	34	++++++++
Total	100	
ii) Households with Members who can Read and Write:		
Not able to read or write	21	+++++
Able to read		
" write		
" read and write	79	++++++++++++++++++
	100	
iii) Households Visited by (any type of) Extension Worker:		
Never been visited	46	++++++++++
Visited very occasionally	7	+
" once per year	11	++
" " " 6 months	5	+
" " " 3 months	7	+
" " " month	9	++
" " " week	7	+
Don't know	5	+
	100	
iv) Households in which Members have Attended Training:		
Never attended training	77	++++++++++++++++++
Attended village meeting	4	.
" day course at training centre	2	.
" village meeting and day course		
" residential course	16	++++
" village meeting and residential course		
" day and residential course		
" village meeting, day and residential course	2	.
	100	

5.2 Travel and communication are difficult in Solomon Islands, with scattered islands of low population densities. Radio offers a means of transmitting information throughout the country, albeit one-way, and in a medium which makes few demands on literacy. In the survey only 12% of households regularly listen to agricultural programmes on the radio, either weekly or monthly. **34%** listen occasionally but **54%** never listen to agricultural programmes. With only **46%** of households listening to agricultural programmes the communication of information may be extended by word of mouth. Problems experienced in the field include access to working radios and the ability among farmers to set aside time to listen to programmes.

5.3 The second part of the table shows the proportion of households in which at least one member is able to read or write. According to these results **79%** of households have at least one member with some reading and writing skills. The survey was unable to verify the level of skills or to substantiate this finding objectively, but the result suggests that simple written materials are an appropriate extension medium. In more general terms, pictural materials would be popular together with simple text and annotation.

5.4 The frequency of extension visits is investigated in the third part of the table, and is illustrated in diagram 5.1.

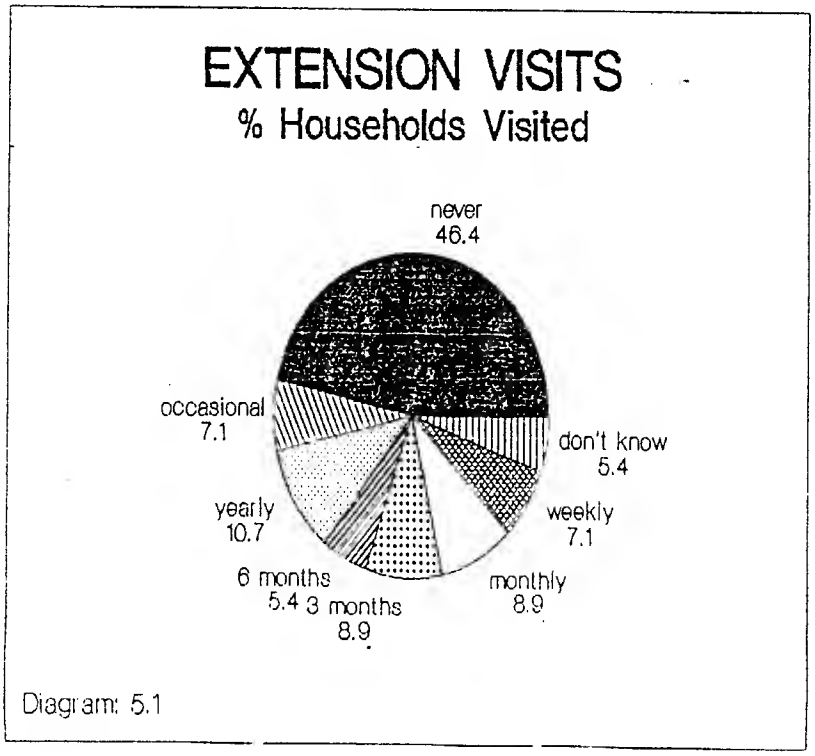


Diagram: 5.1

5.5 Extension in the present study refers to any agricultural worker in government extension, research, NGOs or other organisations. 28% of households are visited regularly at least twice per year, with 16% visited monthly or weekly. 46% of households have never been visited by any type of extension worker.

5.6 Extension faces problems throughout the country in terms of backup and support due to the difficulties of transport and communications, and the funding of programmes.

5.7 The fourth part of table 5.1 describes agricultural training. 77% of households have never participated in any form of agricultural training. Among those that have, training has been mainly in the form of formal sessions at training centres, although it has not been possible within the terms of the present study to investigate the nature of such training. 6% of farmers have been involved in village training based around meetings. There may be scope for improvement through additional support and resources allocated to village level training. A more specific study of extension and training would be justified, since it is not possible in the present exercise to more than highlight selected issues.

5.8 In extension elsewhere it is often found that there is a bias towards more responsive farmers, or programmes may be specifically targetted at them. Such farmers may become "leading farmers" who are expected to adopt rapidly and to demonstrate technologies to other more conservative or risk conscious farmers, who may adopt more slowly over time. The success of such an approach often depends on how representative the leading farmer is of the community as a whole.

5.9 In the development of an extension system it is important to know something about the type of farmers being contacted, and the nature of contacts to ensure that there are no hidden constraints. Table 5.2 describes the relationship between extension visits and the scale and nature of agricultural operations.

Table: 5.2
VISITS BY HOLDING SIZE

Mean size of holding (ha) by frequency of visits

frequency of visits	all holdings			tree crop holdings			non-tree crop holdings		
	size (ha)	obs	% obs	size (ha)	obs	% obs	size (ha)	obs	% obs
all visits	1.31	55	100	3.07	19	100	0.38	36	100
never visited	1.00	26	47	2.62	7	37	0.41	19	53
very occasionally	1.23	4	7	2.35	2	11	0.11	2	6
once per year	3.97	6	11	11.10	2	11	0.40	4	11
six months	1.74	3	5	2.51	2	11	0.20	1	3
three months	0.39	4	7	0.78	1	5	0.26	3	8
month	1.07	5	9	1.91	2	11	0.51	3	8
week	0.80	4	7	1.05	2	11	0.56	2	6
don't know	0.65	3	5	1.46	1	5	0.24	2	6

5.10 The table is in three parts, firstly describing extension coverage among all farmers, secondly for farmers with tree crops (predominantly coconuts), and thirdly for subsistence farmers with no tree crops. Each part of the table shows the mean holding size for each category.

5.11 Extension covers **54%** of households. There is no apparent relationship between holding size and extension visits. **63%** of tree cropping farmers are visited compared to **47%** of non-tree cropping farmers, and tend to be visited more regularly.

5.12 Table 5.3 investigates the relationship between extension visits and whether the farmer holds a position of authority in the community.

Table: 5.3
VISITS BY LOCAL AUTHORITY

frequency of visits	type of authority					
	none	chief	other	none	chief	other
	(number of observations)			(% observations)		
all visits	35	4	16	64	7	29
never visited	19	2	5	35	4	9
very occasionally	2	1	1	4	2	2
once per year	3	1	2	5	2	4
six months	3			5		
three months	1		3	2		5
month	2		3	4		5
week	3		1	5		2
don't know	2		1	4		2

Note: "Other" = church, political, cooperative leader, etc.

5.13 **36%** of farmers held some position of local authority. Since equal probability sampling methods were used, these farmers are not necessarily unrepresentative of the community as a whole. **65%** of community leaders are visited compared to **46%** of other farmers.

5.14 Extension activities appear broad based and provide fairly widespread coverage. There is, howevre, scope for the intensification of extension programmes through the provision of materials and equipment, operating expenses, training and supervision, and backup and support.

Chapter: 6
LIVESTOCK

6.1 Livestock, particularly small stock such as pigs and chickens, are an important feature of smallholder agriculture in Solomon Islands.

6.2 The number of cattle in the 1985 census was 19,750 - a fall of 13.1% from 1984 due largely to destocking in the plantation sector. Overall the national herd was 22% below its peak of 1978, with an average annual fall of 3.4% [4].

6.3 The smallholder sector accounted for 7,612 cattle, 39% of the national herd, showing a decline of 4.1% from the 1984 census. The distribution of cattle throughout the country is shown in table 6.1.

Table: 6.1
CATTLE DISTRIBUTION IN 1985

Province	total cattle	% distribution
Western	4,841	25
Ysabel	1,110	6
Central	2,081	10
Guadalcanal	6,292	32
Malaita	3,810	19
Makira	1,462	7
Temotu	217	1
Total	19,750	100

Source: Statistics Office, 1985 Cattle Census

6.4 In the 1982 Income and Expenditure Survey [3] it was found that 37% of households owned pigs, 30% owned chickens, but only 8% owned cattle. The provincial breakdown is shown in table 6.2.

6.5 According to the 1986 Population Census [2] 2% of households earned income from cattle, 12% earned income from pigs and 10% earned income from poultry.

Table: 6.2
LIVESTOCK DISTRIBUTION IN 1982

Province	% households owning		
	cattle	pigs	chickens
Western	2	19	24
Ysabel	42	25	47
Central		28	7
Guadalcanal	2	63	41
Malaita	9	35	28
Makira	10	69	63
Temotu		40	4
Total	8	37	30

Source: Statistics Office, 1982 HH Income and Expenditure Survey

6.6 In the present survey 16% of households earned income from livestock (table 4.2).

6.7 Table 6.3 summarises livestock ownership in the survey area, and is divided into three columns. The first, entitled "ownership %", specifies the percentage of households which own livestock. The middle two columns show mean stock held: firstly among livestock owning households (owners); and secondly as an average of all farmers in the survey area (both owners and non-owners). To the right of the table is a histogram summary of ownership based on the mean among all farmers.

6.8 The table is divided horizontally into three main parts. The first part specifies stock numbers kept predominantly for home use, but which may include occasional sales. The second part specifies stock numbers where livestock comprise an income earning enterprise. The third part is the overall mean of livestock ownership irrespective of type of enterprise. (Note that overall mean ownership figures are derived from the original data and may not be obtained from summation of the table entries above).

6.9 At the foot of the table is a component on novel livestock enterprises, such as bees, butterflies and crocodile farming. One surveyed farmer produced honey.

Table: 6.3
LIVESTOCK

Livestock Ownership:

	ownership %	(-- mean ownership among owners	--) all farmers	summary all farmers
i) Non-commercial				
Cattle				
Pigs	45	3.60	1.61	++++++
Goats				
Chickens	46	11.92	5.54	++++++++++++++++++++
Ducks	6	2.00	0.11	.
Horses				
ii) Commercial				
Cattle	2	9.00	0.16	.
Pigs	4	4.50	0.16	.
Goats				
Chickens	4	11.50	0.41	+
Ducks	2	2.00	0.04	.
Horses				
iii) Total				
Cattle	2	9.00	0.16	.
Pigs	46	3.81	1.77	+++++++
Goats				
Chickens	46	12.81	5.95	++++++++++++++++++++
Ducks	5	2.67	0.15	.
Horses				

iv) Households Earning Income	(---- % households by activity ----) individual	group	
Income from:			
1. Bees or honey	1.80	1.80	++++++++++++++++++
2. Butterflies			
3. Bees and Butterflies			
4. Crocodiles			
5. Bees and crocodiles			
6. Butterflies and crocodiles			
7. Bees, butterflies and crocodiles			

6.10 The most important livestock in the survey area are pigs and chickens. 2% (1 in the sample) of farmers own cattle with a herd size of 9 head. Cattle are kept as a commercial enterprise, although bush killings are practiced, and substitute for labour in the management of coconut plantations. Cattle grazing on pasture under coconuts release labour from brushing, and they can make use of otherwise waste and swampy land. Cattle require no housing although paddocks are wire fenced and, unlike pigs, do not compete with the family for food. Cattle are generally managed by the father of the household and eldest sons. Stock will be inspected two or three times per week when fences are checked. If there is no bull for breeding one may be borrowed locally, but if the household is unable to perform dehorning and castration the veterinary agent is called.

6.11 Pigs play an important role in the custom and life of rural households. In the past they would be sacrificed to the gods, but nowdays are kept mainly for traditional feasts such as at weddings; for the settlement of disputes between families or clans, commonly over land; and as compensation when customs are violated. Pigs may also be used as prizes for important events, such as football matches. Pigs may be sold, often to pay for shell money or for cash needed as part of a bride price, for school fees, or for important traditional functions. Commonly piglets are sold to raise cash.

6.12 In the survey area **46%** of farmers keep pigs, mainly for "home use", with a mean herd size of **3.81** among owners. Pigs are kept by **4%** of farmers (2 farmers) as a "commercial" enterprise, but with a small mean herd size of **4.5**.

6.13 Pigs are commonly kept in walled caves along the coast or in wooden pens above the mangrove shore. This protects gardens from marauding pigs and safeguards the pigs from theft. Penning in this way requires that the owners feed and water the pigs in the morning and again in the evening, and clean out the pens. Generally the mother and elder daughters look after the pigs, which are fed on scraps and various root crops.

6.14 Pigs are generally kept fairly close to the household and the time spent in tending pigs is relatively minor in relation to garden work. If the farmer wants to breed piglets to sell, he will commonly borrow a boar if he does not have his own.

6.15 Chickens are of lesser importance in the traditions and lives of local people and are not used in ceremonial functions. They are largely kept for food, and are especially important at Christmas. Chickens are easy to keep, they provide meat and eggs, and earn income for the family through sales.

6.16 Chickens are kept by **46%** of households with a mean flock size of **12.81** among owners. Two farmers, or **4%** of sampled farmers, keep chickens commercially with a mean flock size of **11.5**.

6.17 Chickens are commonly housed at night, in houses of bush materials to safeguard them from attack by dogs and from theft. They are released during the day time and so are not generally fed or watered.

6.18 Chickens generally require little or no management and are often looked after by the young children of the family.

6.19 Ducks are of minor importance, owned by **5%** of households with a mean flock size of **2.67** among owners. As with chickens, ducks are kept under minimal management.

Chapter: 7
HOLDING SIZE DISTRIBUTION

7.1 Holding size distribution is of interest because it provides an understanding of the structure of agriculture and may help to explain constraints faced by farmers or response to services.

7.2 Table 7.1.i describes the holding size distribution of the survey area. Holdings are not spread normally about the mean of **1.312ha** but are skewed, in that many farmers have very small holdings while a few have comparitively large holdings. As a result **55%** of farmers have holdings less than **0.5ha** in size, and over **75%** of farmers have holdings less than the mean size of 1.312ha. This can be seen clearly in diagram 7.1 which shows that the majority of farmers fall in the low holding size classes, while a few large holdings dominate the area distribution.

7.3 The mean describes the "average" holding size and is of interest in that it provides a value for the "middle" of the data based on the spread of values. This may be misleading when unbalanced extreme values occur, as seen in the present results since three quarters of farmers fall below the mean holding size and only a quarter are above it.

7.4 Another measure of central tendency is the median, or "mid-point", the value of the middle item when the data are arranged in order. In a "normal distribution" the median and the mean coincide. The median in this case is **0.428ha** indicating that skewness in the holding size distribution needs to be taken into account when considering the mean holding of 1.312ha.

7.5 An indicator of variability is the range, which is derived from extremes in the data. The minimum area is **0.038ha** and the maximum is **20.466ha**, a range of **20.428ha**. This shows that holding sizes are widely spread and that the mean falls towards the lower end of the range. Holdings are "positively skewed" because some relatively high values are not offset by corresponding low values. In diagram 7.1 it can be seen that the holding distribution is almost the reverse of the area distribution.

7.6 The standard deviation is a measure of variation based on the extent to which values deviate from the mean. If the data are closely bunched the standard deviation is small, and if they are widely spread it is large. In a normal distribution 68% of values lie within 1 standard deviation on either side of the mean, and 95% within 2 standard deviations. In the survey results the mean of **1.312ha** has a standard deviation of **2.879** and a coefficient of variation of **219%** (the standard deviation expressed as a percentage of the mean).

7.7 Skewness is an index of symmetry in the data. A normal distribution is symmetrical about the mean, with a skewness coefficient of zero, whereas a skewed distribution has a longer "tail" on one side than the other. The present data have a skewness of **5.755** indicating high positive skewness.

7.8 Kurtosis is the extent to which the data cluster around a central point. When this occurs the distribution appears "peaked", as in the present data set, which is said to be "leptokurtic". Positive values of kurtosis indicate that the distribution is more peaked than normal. In the present data set the coefficient of kurtosis is **37.558**.

7.9 The indications are that there is considerable inequality in holding size distribution, which may be viewed in standard form in diagram 7.2. The diagonal represents the holding size distribution for equality and the curve below represents the actual (cumulative) holding size distribution. The area between the diagonal and the curve is the "area of inequality". The larger the area of inequality, the more unequal the holding size distribution. This may be expressed as an index, called the "Gini coefficient", which is the area between the two lines expressed as a proportion of the area of the triangle below the diagonal. The Gini coefficient ranges from 0 (for perfect equality) to 1 (for perfect inequality). The Gini coefficient here is **0.64**, indicating considerable inequality.

Table: 7.1
HOLDING SIZE DISTRIBUTION

i) All holdings and all crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	⟨------- % --------⟩ holdings	area	⟨-- cumulative % --⟩ holdings	area
0 - .25	14	0.1554	2.18	25	3	25	3
.25 - .5	16	0.3603	5.76	29	8	55	11
.5 - .75	3	0.6432	1.93	5	3	60	14
.75 - 1	5	0.8656	4.33	9	6	69	20
1 - 1.25	3	1.0309	3.09	5	4	75	24
1.25 - 1.5	2	1.3747	2.75	4	4	78	28
1.5 - 1.75	2	1.6499	3.30	4	5	82	32
1.75 - 2	1	1.8537	1.85	2	3	84	35
2 - 2.5	2	2.1996	4.40	4	6	87	41
2.5 - 3	3	2.8158	8.45	5	12	93	53
3 - 5	2	3.7514	7.50	4	10	96	63
5 - 10	1	6.1419	6.14	2	9	98	72
10 - highest	1	20.4663	20.47	2	28	100	100
Total	55	1.3118	72.15	100	100		

Mean	1.312	S.E. Mean	0.388
Median	0.428	Coef. of Var %	219
Std Dev	2.879	Variance	8.291
Kurtosis	37.558	S.E. Kurtosis	0.634
Skewness	5.755	S.E. Skewness	0.322
Range	20.428	Minimum	0.038
Maximum	20.466	Sum	72.151
Gini	0.654		

Note that the main table is a frequency distribution of grouped intervals, while the statistics at the foot of the table describe the ungrouped data set.

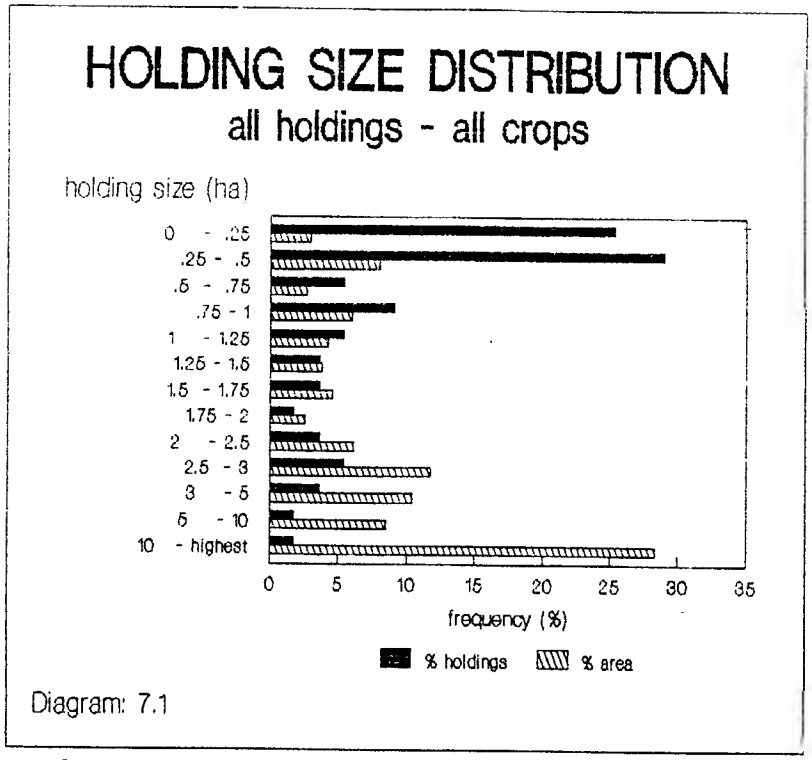


Diagram: 7.1

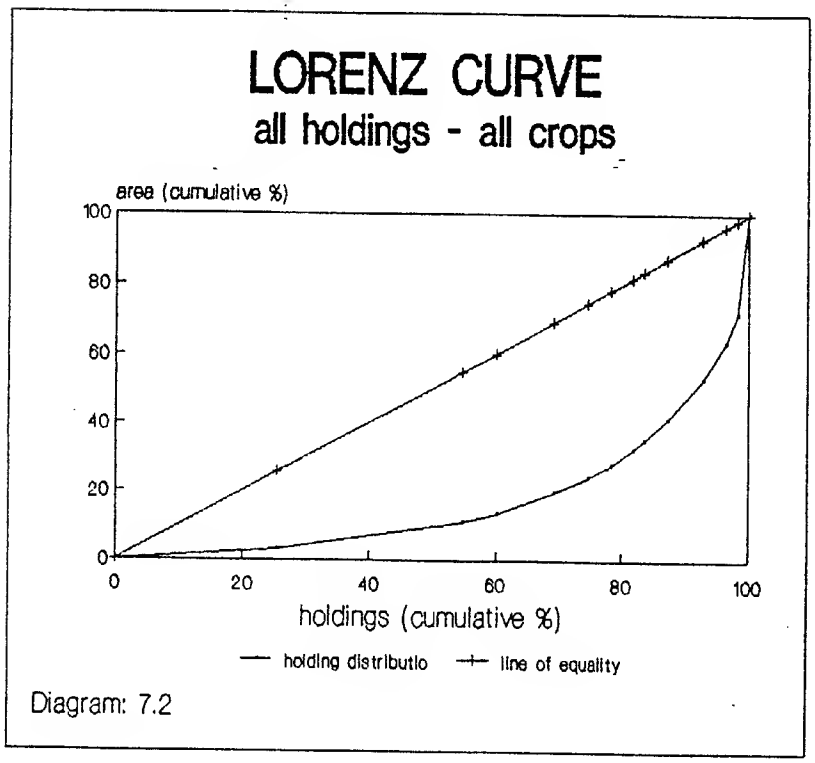


Diagram: 7.2

7.10 Table 8.1.ii shows the holding size distribution of only those farmers who have tree crops. The sample is reduced from 55 to 19, and so the stratum of farmers with tree crops represents 35% of all farmers in the sample.

7.11 The mean holding size among tree cropping farmers is 3.073ha and the median is 1.854ha. The coefficient of skewness has dropped to 3.685 and kurtosis has fallen to 14.719. The range remains wide, but the distribution is less scattered, with a coefficient of variation of 145%.

ii) Holdings with tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	(------- % --------) holdings	area	(-- cumulative % --) holdings	area
0 - .25							
.25 - .5	2	0.3225	0.65	11	1	11	1
.5 - .75						11	1
.75 - 1	1	0.7796	0.78	5	1	16	2
1 - 1.25	2	1.0463	2.09	11	4	26	6
1.25 - 1.5	2	1.3747	2.75	11	5	37	11
1.5 - 1.75	2	1.6499	3.30	11	6	47	16
1.75 - 2	1	1.8537	1.85	5	3	53	20
2 - 2.5	2	2.1996	4.40	11	8	63	27
2.5 - 3	3	2.8158	8.45	16	14	79	42
3 - 5	2	3.7514	7.50	11	13	89	54
5 - 10	1	6.1419	6.14	5	11	95	65
10 - highest	1	20.4663	20.47	5	35	100	100
Total	19	3.0725	58.38	100	100		

Mean	3.073	S.E. Mean	1.019
Median	1.854	Coef. of Var %	145
Std Dev	4.443	Variance	19.739
Kurtosis	14.719	S.E. Kurtosis	1.014
Skewness	3.685	S.E. Skewness	0.524
Range	20.182	Minimum	0.285
Maximum	20.466	Sum	58.378
Gini	0.515		

7.12 The new distribution of farmers with tree crops is illustrated in diagram 7.3, and its associated Lorenz curve in diagram 7.4. Inequalities have been reduced since the majority of small farmers are excluded, with a resultant rise in mean and median holding size; a drop in variability; and greater equality among tree cropping farmers, with a Gini coefficient of 0.515.

HOLDING SIZE DISTRIBUTION

holdings with tree crops

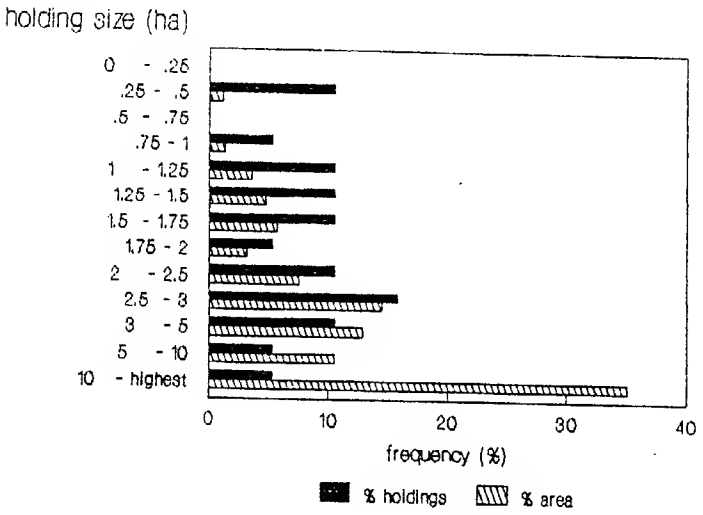


Diagram: 7.3

LORENZ CURVE

holdings with tree crops

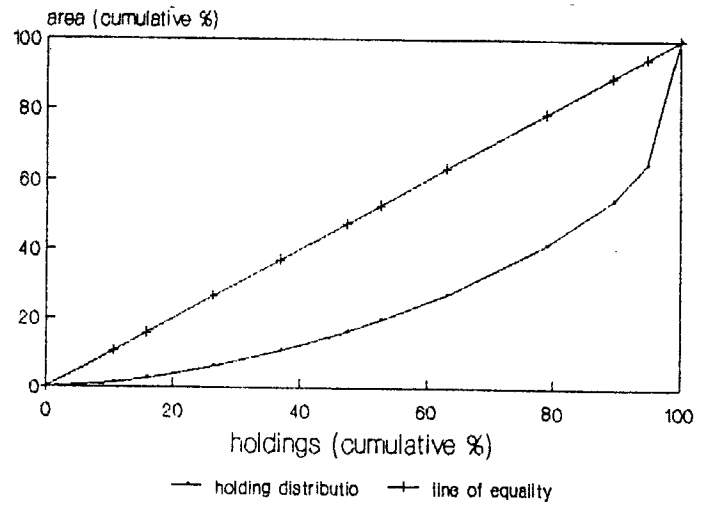


Diagram: 7.4

7.13 There remains considerable variability among farmers with tree crops, since there is a wide range in holding size. The stratum of farmers with no tree crops is shown in table 7.1.iii.

7.14 The majority of farmers do not have tree crops. The stratum contains 36 farmers, or **65%** of sampled farmers. The mean holding size is **0.383ha** and the median **0.315ha**. The range is small; skewness has dropped to **1.002**; and kurtosis to **0.079**. The distribution is much more normal, with a coefficient of variation of **69%**.

7.15 The holding size distribution is illustrated in diagram 7.5, and its associated Lorenz curve in diagram 7.6. Inequality is low, since the graph of % holdings and % area largely coincide, and the Gini coefficient has fallen to **0.361**.

iii) Holdings without tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	(------- % --------) holdings	area	(-- cumulative % --) holdings	area
0 - .1	3	0.0486	0.15	8	1	8	1
.1 - .2	9	0.1738	1.56	25	11	33	12
.2 - .3	4	0.2599	1.04	11	8	44	20
.3 - .4	9	0.3523	3.17	25	23	69	43
.4 - .5	3	0.4587	1.38	8	10	78	53
.5 - .6	1	0.5367	0.54	3	4	81	57
.6 - .7	1	0.6642	0.66	3	5	83	62
.7 - .8	1	0.7286	0.73	3	5	86	67
.8 - .9	3	0.8721	2.62	8	19	94	86
.9 - 1	1	0.9322	0.93	3	7	97	93
1 - 1.5	1	1.0002	1.00	3	7	100	100
1.5 - 2						100	100
2 - highest						100	100
Total	36	0.3826	13.77	100	100		

Mean	0.383	S.E. Mean	0.044
Median	0.315	Coef. of Var %	69
Std Dev	0.265	Variance	0.070
Kurtosis	0.079	S.E. Kurtosis	0.768
Skewness	1.002	S.E. Skewness	0.393
Range	0.962	Minimum	0.038
Maximum	1.000	Sum	13.775
Gini	0.361		

Note the smaller size classes in this table with respect to previous tables.

HOLDING SIZE DISTRIBUTION

holdings without tree crops

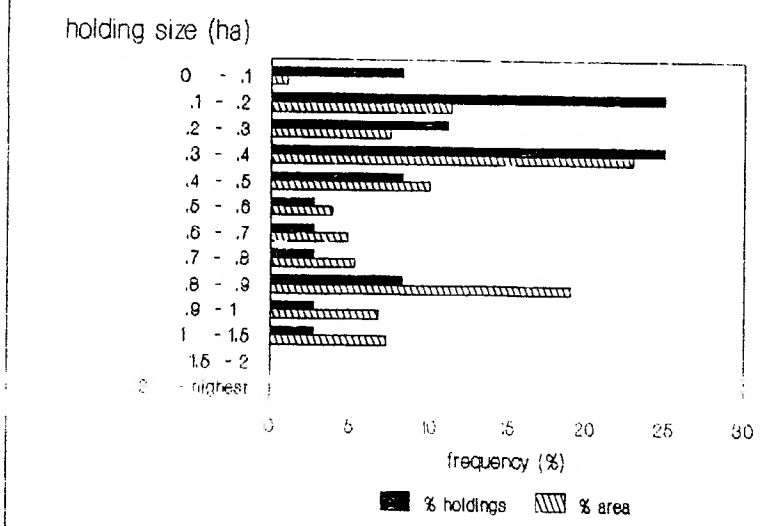


Diagram: 7.5

LORENZ CURVE

holdings without tree crops

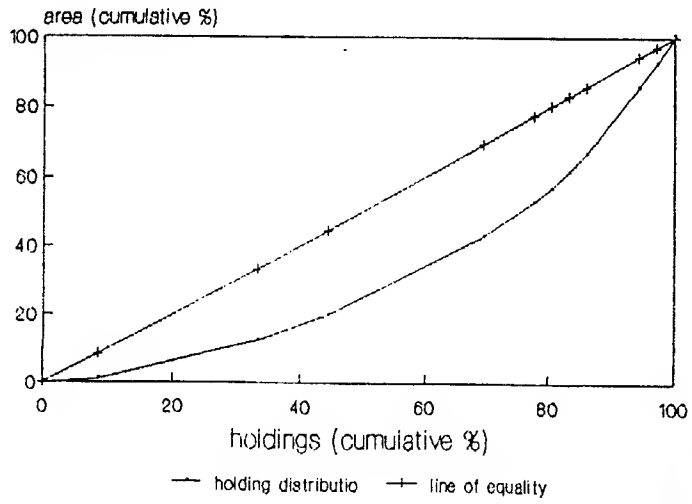


Diagram: 7.6

7.16 Table 7.1.iv describes the holding size distribution of all farmers, but excluding tree crop areas. The holding size distribution is illustrated in diagrams 7.7 and 7.8. These results are similar to those for non-tree crop farmers, indicating that subsistence cropping is similar among all farmers with a mean area of **0.404ha.**

iv) All holdings - total area excluding tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	(------- % --------) holdings	area	(-- cumulative % --) holdings	area
0 - .1	5	0.0668	0.33	9	2	9	2
.1 - .2	12	0.1664	2.00	22	9	31	10
.2 - .3	8	0.2589	2.07	15	9	45	20
.3 - .4	10	0.3478	3.48	18	16	64	35
.4 - .5	7	0.4521	3.16	13	14	76	50
.5 - .6	1	0.5367	0.54	2	2	78	52
.6 - .7	2	0.6440	1.29	4	6	82	58
.7 - .8	1	0.7286	0.73	2	3	84	61
.8 - .9	4	0.8742	3.50	7	16	91	77
.9 - 1	2	0.9360	1.87	4	8	95	85
1 - 1.5	3	1.0882	3.26	5	15	100	100
1.5 - 2						100	100
2 - highest						100	100
Total	55	0.4042	22.23	100	100		

Mean	0.404	S.E. Mean	0.039
Median	0.314	Coef. of Var %	72
Std Dev	0.292	Variance	0.085
Kurtosis	0.302	S.E. Kurtosis	0.634
Skewness	1.085	S.E. Skewness	0.322
Range	1.185	Minimum	0.038
Maximum	1.223	Sum	22.231
Gini	0.377		

HOLDING SIZE DISTRIBUTION

all holdings excluding tree crops

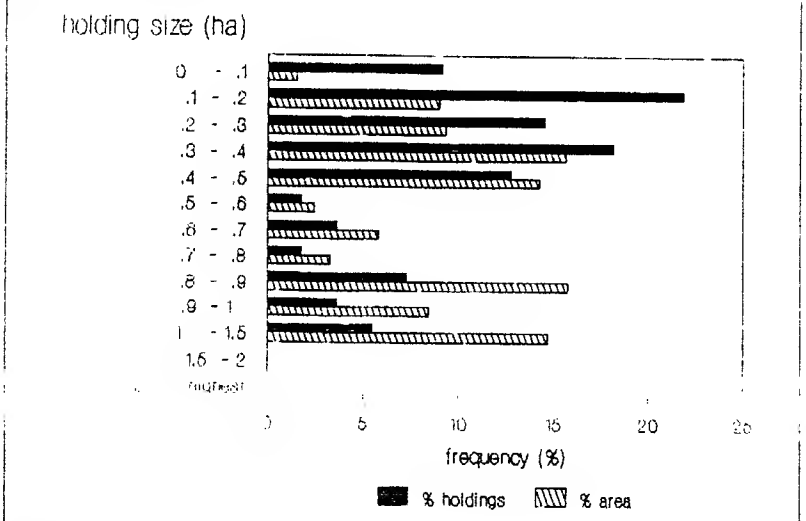


Diagram: 7.7

LORENZ CURVE

all holdings excluding tree crops

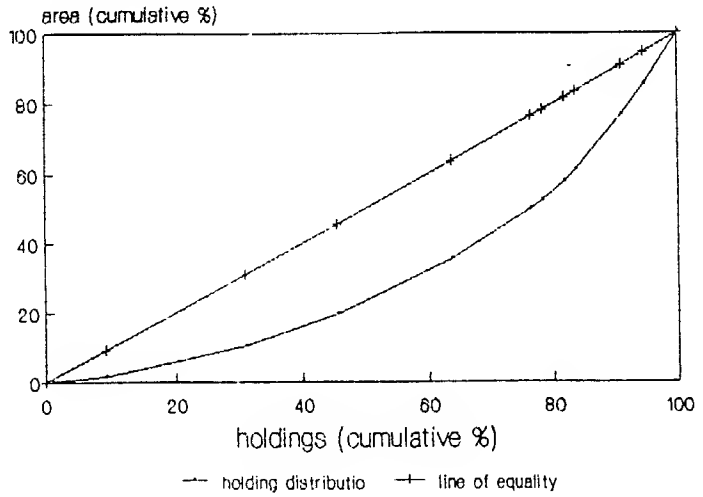


Diagram: 7.8

7.17 Table 7.1.v describes the size distribution of tree crop areas, illustrated in diagrams 7.9 and 7.10.

v) All holdings - total area of tree crops only

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	% holdings	% area	cumulative % holdings	cumulative % area
0 - .25	2	0.1084	0.22	11	0	11	0
.25 - .5						11	0
.5 - .75	3	0.6456	1.94	16	4	26	4
.75 - 1	2	0.8849	1.77	11	4	37	8
1 - 1.25						37	8
1.25 - 1.5	2	1.3375	2.68	11	5	47	13
1.5 - 1.75	2	1.5857	3.17	11	6	58	20
1.75 - 2	2	1.9474	3.89	11	8	68	27
2 - 2.5	1	2.1714	2.17	5	4	74	32
2.5 - 3	2	2.7986	5.60	11	11	84	43
3 - 5	1	3.3918	3.39	5	7	89	50
5 - 10	1	5.1003	5.10	5	10	95	60
10 - highest	1	19.9962	20.00	5	40	100	100
Total	19	2.6274	49.92	100	100		

Mean	2.627	S.E. Mean	1.005
Median	1.546	Coef. of Var %	167
Std Dev	4.382	Variance	19.204
Kurtosis	15.620	S.E. Kurtosis	1.014
Skewness	3.823	S.E. Skewness	3.823
Range	19.893	Minimum	0.103
Maximum	19.996	Sum	49.922
Gini	0.573		

Note that the size classes are the same as for tables i and ii.

HOLDING SIZE DISTRIBUTION

all holdings - tree crops only

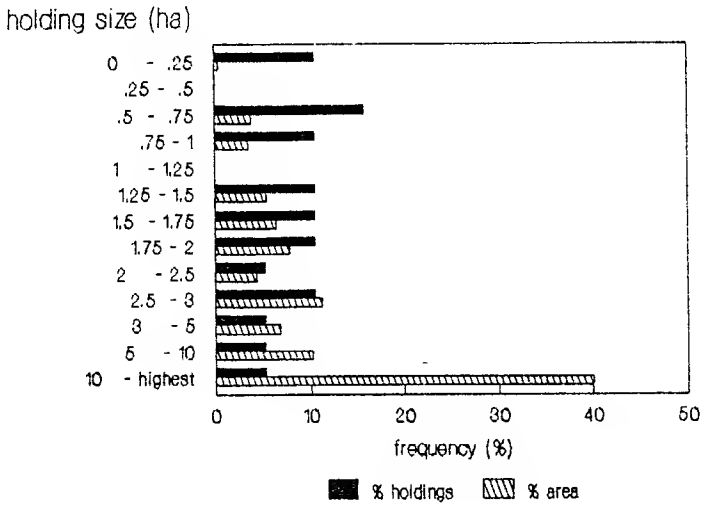


Diagram: 7.9

LORENZ CURVE

all holdings - tree crops only

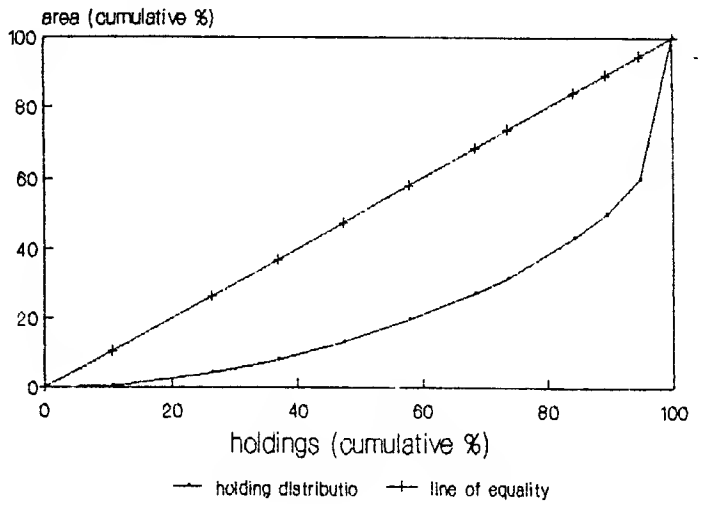


Diagram: 7.10

7.18 Indicators of variability are again high confirming that a large proportion of holding size inequality among smallholder farmers can be explained by tree cropping. The subsistence component of holdings is relatively uniform, while considerable variability is seen in tree crop, in this case coconut, areas.

7.19 In summary, inequality in holding size is largely explained by differences in tree cropping. **65%** of farmers do not grow tree crops and have a mean holding size of **0.383ha**. The **35%** of farmers who do grow tree crops have a mean holding size of **3.073ha**. Combined, the mean holding size is **1.312ha** but this is not a reliable "average". When partitioned, the subsistence operations of all farmers amount to a mean area of **0.404ha**, while the average area of tree crops among 41% of farmers is **2.627ha**.

Chapter: 8
LABOUR DENSITY

8.1 According to Bathgate[18] "increments in the population of a household do not result in an expansion in the garden area. Instead, the garden area holds constant and ... the actual area per consumption and labour unit decreases ... Although there is a variation ... the average household ... tends to clear a fairly similar amount of land for gardens and plant a similar area of root crops". Bathgate postulates that there is no relationship between household size and food garden area. Larger family sizes are not then associated with larger holdings, and he attributes this to a tendency among subsistence producers to cultivate in excess of household requirements as insurance against crop failure.

8.2 In the present survey the area of food crops is found to be relatively constant in comparison to a variabile tree crop area. Table 8.1 shows the relationship between holding size and labour availability.

Table: 8.1
LABOUR DENSITY - ALL HOLDINGS

holding size class (ha)	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	3.27	1.31	2.49	55
< .25	2.97	0.16	19.12	14
.25 - .5	3.08	0.36	8.53	16
.5 - .75	3.37	0.64	5.23	3
.75 - 1	3.50	0.87	4.04	5
1 - 1.25	5.00	1.03	4.86	3
1.25 - 1.5	2.10	1.37	1.53	2
1.5 - 1.75	3.15	1.65	1.91	2
1.75 - 2	4.60	1.85	2.48	1
2 - 2.5	2.90	2.20	1.32	2
2.5 - 3	3.80	2.82	1.35	3
3 - 5	4.50	3.75	1.20	2
5 - 10	3.20	6.14	0.52	1
> 10	2.00	20.47	0.10	1

8.3 There is little to suggest that larger holdings have more available labour, and so the present results are in agreement with Bathgate's findings. Labour density falls rapidly from 19.12 adult units per hectare for the smallest holding class (less than 0.25ha) to 0.10 units in the largest (greater than 10ha) class. Small holdings then have a high labour density while large holdings have a low labour density, as seen in diagram 8.1.

8.4 With a mean labour density of 2.49 labour units per hectare (which applies to most holdings of less than 1.25ha), labour is unlikely to be limiting on small holdings, but it may be on larger holdings.

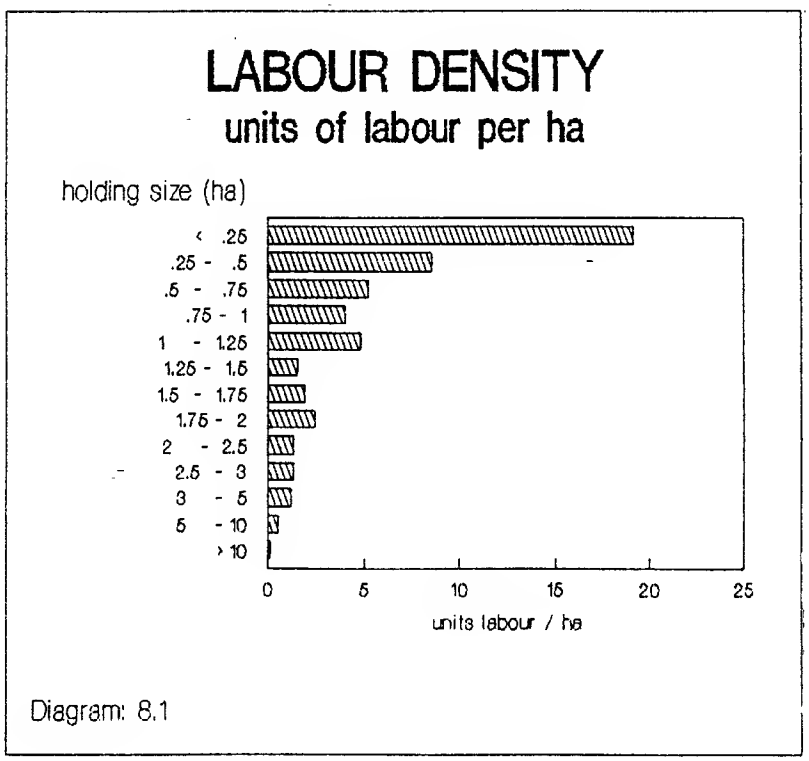


Diagram: 8.1

8.5 Holdings without tree crops are shown in table 8.2.

Table: 8.2
LABOUR DENSITY - NON-TREE CROP HOLDINGS

holding size class (ha)	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	3.11	0.38	8.12	36
< .25	2.97	0.16	19.12	14
.25 - .5	3.16	0.37	8.65	14
.5 - .75	3.37	0.64	5.23	3
.75 - 1	3.23	0.89	3.64	4
1 - 1.25	2.90	1.00	2.90	1
1.25 - 1.5				
1.5 - 1.75				
1.75 - 2				
2 - 2.5				
2.5 - 3				
3 - 5				
5 - 10				
> 10				

8.6 The range of holding size is much smaller but again there is no evident relationship between holding size and labour availability. With a much higher mean labour density of 8.12 labour units per hectare, even the largest holdings of up to 1.25ha in size have a labour availability of 2.90 units per hectare. There is a sharp decline in labour density from 19.12 to 2.90 units per hectare over the holding size range, but holdings in general have a high labour density.

8.7 Holdings with tree crops are shown in table 8.3.

Table: 8.3
LABOUR DENSITY - TREE CROP HOLDINGS

holding size class (ha)	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	3.58	3.07	1.17	19
< .25				
.25 - .5	2.45	0.32	7.60	2
.5 - .75				
.75 - 1	4.60	0.78	5.90	1
1 - 1.25	6.05	1.05	5.78	2
1.25 - 1.5	2.10	1.37	1.53	2
1.5 - 1.75	3.15	1.65	1.91	2
1.75 - 2	4.60	1.85	2.48	1
2 - 2.5	2.90	2.20	1.32	2
2.5 - 3	3.80	2.82	1.35	3
3 - 5	4.50	3.75	1.20	2
5 - 10	3.20	6.14	0.52	1
> 10	2.00	20.47	0.10	1

8.8 Again there is no evident relationship between holding size and labour availability. The mean labour density is 1.17 units per hectare, falling off sharply from 7.60 units per hectare on holdings of less than 0.25ha in size to 0.10 units per hectare on holdings of greater than 10ha.

8.9 Larger holdings may then experience labour constraints. There is unlikely to be a labour problem on food gardens, but there may be a shortage of labour for the management of tree crops.

8.10 It was not possible to investigate land use constraints for instance whether small holdings are small because of restricted land use rights. This is known to occur in other survey areas and would be a useful area of further study.

Chapter: 9
CROPPING PATTERNS

9.1 A "holding" is taken here to be the total area cultivated by a household. It includes all crops growing and land cleared, but does not include fallow which the family may have rights to cultivate.

9.2 A holding is divided into one or more "gardens", which are contiguous blocks of land growing similar crops. Only broad distinctions are made among crop types in gardens.

9.3 A garden may be subdivided into "plots" which are blocks within each garden growing a different crop mix, under different management, or planted at different times. Within plots detailed crop mixtures are recorded.

9.4 Table 9.1 describes cropping patterns at the garden level, maintaining the distinction between farmers who grow tree crops and those who do not.

9.5 Tree crop farmers have a mean holding size of **3.09ha**, of which **2.62ha** is tree crops and **0.46ha** food crops. In contrast, non-tree crop farmers have a mean holding size of **0.37ha**.

9.6 Tree cropping farmers tend to have more complex holdings, with an average of **4.05** gardens and **6.69** plots compared with **2.19** gardens and **3.11** plots among non-tree crop farmers.

9.7 Table 9.2 describes cropping patterns in more detail. This is derived from the aggregation of plot information in which complex mixtures are summarised by the dominant crop. 9 major crop mixture classes are listed in table 9.2, predominantly tree crops and root crops.

Table: 9.1
CROP COMPOSITION

i) All holdings

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land		0.02	0.02	1.00	
tree crops	0.91	0.67	0.87	1.30	+++++++++
short term cash crops					
food crops	0.40	2.15	3.45	1.60	++++
total	1.31	2.84	4.34	1.53	

number of observations = 55

ii) Holdings with tree crops

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land	0.01	0.05	0.05	1.00	.
tree crops	2.62	1.95	2.53	1.30	++++++++++++++++++++++++
short term cash crops					
food crops	0.46	2.05	4.11	2.00	++++
total	3.09	4.05	6.69	1.65	

number of observations = 19

iii) Holdings without tree crops

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops					
short term cash crops					
food crops	0.37	2.19	3.11	1.42	+++
total	0.37	2.19	3.11	1.42	

number of observations = 36

Table: 9.2
CROPPING PATTERNS

	main crop in mixture	all farmers		farmers with no tree crops		farmers with tree crops	
		area (ha)	%	area (ha)	%	area (ha)	%
a	Cleared Land	0.014	1	0.003	1	0.035	1
b	Coconut	0.835	64			2.296	77
c	Cocoa	0.061	5			0.168	6
d	Cattle under coconuts						
e	Grain Crops						
f	Beans						
g	Cabbage						
h	Vegetables						
i	Spices						
j	Fruit Crops	0.019	1			0.052	2
k	Fruit trees						
l	Banana						
m	Citrus trees						
n	Nut trees	0.004	0			0.011	0
o	Sugar cane						
p	Food/building tree						
q	Tobacco						
r	Sweet Potato	0.107	8	0.104	28	0.113	4
s	Taro						
t	Yam	0.051	4	0.033	9	0.084	3
u	Pana	0.212	16	0.213	58	0.209	7
v	Cassava	0.009	1	0.012	3	0.003	0
w	Other root crop						
	Total mean area (ha)	1.312		0.365		2.969	
	Number of households	55		35		20	

9.8 The spatial dominance of coconut cropping on farming systems is seen clearly in diagrams 9.1 to 9.3. Coconuts account for 64% of the total area but are grown by only 36% of farmers, suggesting that there are two major types of farmer in the survey area. The gardens under annual crops among tree cropping farmers tend to be more diverse in terms of main crop type (table 9.2), and more complex (table 9.1) than those among non-tree crop farmers. Tree crop farmers grow more fruit and nut trees as main crops, and tend to have larger root crop areas.

9.9 Table 9.2 is a simplification of cropping patterns found in the field. Table 9.3 describes in more detail the crop mixtures grown by farmers. This no longer applies to a "model" holding, but detailed cropping patterns may be used to determine proportional areas under crop mixtures.

9.10 Mixtures are listed hierarchically to the left of the table according to the relative dominance of each crop in the mixture. The three main crops in any mixture are listed by name and any further crops are referred to by code letters. The column of "mean plot area" records the mean area of plots measured in the field according to the number of observations shown in the next column to the right. The column on the far right is the proportional area by crop mixture.

9.11 Crop mixtures illustrate the complexity of smallholder farming systems, in which 69 distinct mixtures are recorded. Small areas of vegetable and short term cash crops are typically scattered among food gardens. Tree crops are important, both within cultivated gardens and in the fallow of former gardens.

9.12 Table 9.4 summarises tree cropping. The table is in two parts, first showing the average number of trees and second the number of observations on which they are based. Each table is subdivided horizontally into cultivated garden and fallow, and vertically by garden type.

9.13 The averages in the top table are based on all plots (not only the plots in which trees are grown). In the far right column of the lower table is listed the number of observations for which trees are too numerous to count. These are excluded from the averages in the upper table.

CROPPING PATTERNS

all farmers

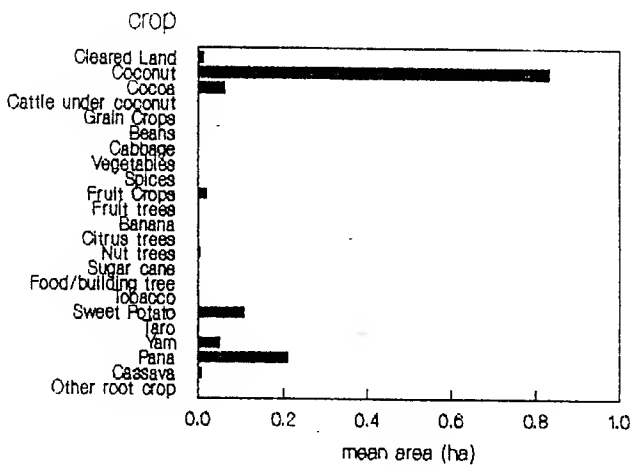


Diagram: 9.1

CROPPING PATTERNS
farmers with no tree crops

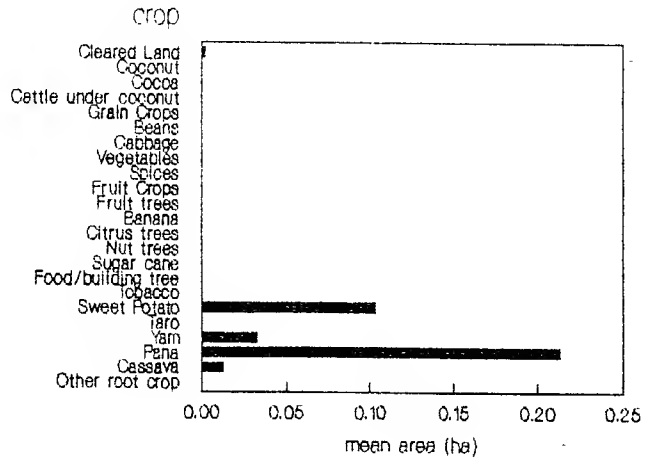


Diagram: 9.2

CROPPING PATTERNS
farmers with tree crops

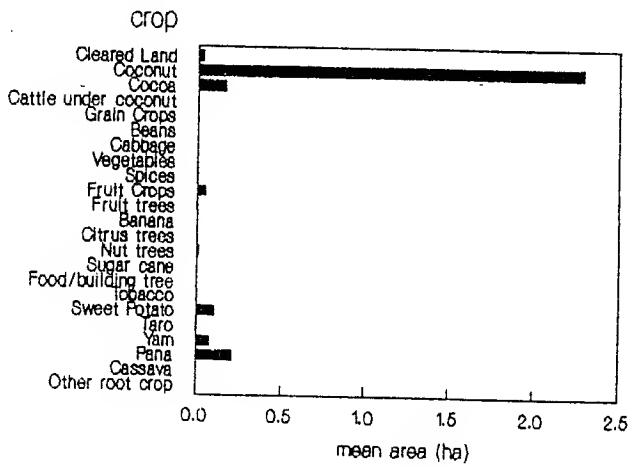


Diagram: 9.3

Table: 9.3
DETAILED CROPPING PATTERNS

crop code	main crop in mixture (crop name) first	second	third	minor mixture code	mean plot area (ha)	number of plots	% plots	% area
TOTAL					0.0461	240	100	100
a	Cleared land				0.0379	9	4	1.096
b	Coconut				1.2565	36	15	62.69
		Cocoa			0.6871	1	0	0.952
c	Cocoa				0.4192	8	3	4.648
j	Fruit crops				1.0443	1	0	1.447
n	Nut trees				0.1507	1	0	0.208
		Sweet Potato			0.0586	1	0	0.081
r	Sweet Potato				0.0930	34	14	4.382
		Grain crops			0.1287	1	0	0.178
		Fruit crops	Banana	vs	0.1691	1	0	0.234
		Banana			0.0610	2	1	0.168
			Spices		0.0534	1	0	0.074
			Fruit crops		0.0735	1	0	0.101
			Cassava	j	0.0838	1	0	0.116
		Taro	Banana		0.1259	1	0	0.174
				j	0.0852	1	0	0.118
		Pana			0.0851	5	2	0.589
			Cassava		0.0590	2	1	0.163
				l	0.1008	1	0	0.139
		Cassava			0.0970	3	1	0.403
			Cabbage	l	0.0257	1	0	0.035
			Fruit crops	el	0.1625	1	0	0.225
				l	0.1914	2	1	0.530
			Banana		0.0656	2	1	0.181
			Yam	u	0.1126	1	0	0.156
			Pana		0.1409	1	0	0.195
t	Yam				0.0873	9	4	1.088
		Banana			0.0191	1	0	0.026
		Pana			0.1322	12	5	2.198
			Grain crops	sl	0.0553	1	0	0.076
			Banana		0.1182	2	1	0.327
			Sweet potato		0.1074	1	0	0.148
			Cassava	l	0.0256	1	0	0.035

CROPPING PATTERNS (continued)

crop code	main crop in mixture — crop name: first	second	third	minor mixture code	mean plot area (ha)	number of plots	% plots	% area
u	Pana				0.1106	32	13	4.902
		Grain crops			0.0775	2	1	0.214
		Vegetable	Fd/build tree	o1	0.1792	1	0	0.248
		Fruit crops	Banana		0.0624	1	0	0.086
		Banana			0.1459	3	1	0.606
			Taro	vg	0.0969	1	0	0.134
				o	0.1156	1	0	0.160
				sg	0.0397	1	0	0.055
		Sweet potato			0.2940	2	1	0.814
			Grain crops	v	0.0439	2	1	0.121
			Banana	svjg	0.1738	1	0	0.240
				ts	0.0788	1	0	0.109
			Taro	qg1	0.0967	1	0	0.134
		Yam			0.1333	16	7	2.955
			Banana		0.3372	3	1	1.402
				g	0.0826	1	0	0.114
				gj	0.0378	1	0	0.052
				sjh	0.2268	1	0	0.314
				sqvr	0.1705	1	0	0.236
				v	0.1743	1	0	0.241
			Tobacco	g1	0.1156	1	0	0.160
			Sweet potato		0.1978	1	0	0.274
				e	0.1297	1	0	0.179
				v	0.0370	1	0	0.051
			Taro		0.1127	1	0	0.156
			cassava	l	0.1422	2	1	0.394
				lf	0.1554	1	0	0.215
				lgo	0.0825	1	0	0.114
				rlsg	0.4186	1	0	0.580
		Cassava			0.0705	5	2	0.488
			Banana		0.0844	1	0	0.116
			Tobacco	li	0.1950	1	0	0.270
v	Cassava				0.0538	1	0	0.074
		Sweet Potato			0.0457	1	0	0.063
		Pana	Tobacco		0.1652	1	0	0.228
			Taro	ljio	0.2065	1	0	0.286

Crop Key:

a Cleared land	j Fruit crops	r Sweet potato
b Coconut	k Fruit trees	s Taro
c Cocoa	l Banana	t Yam
e Grain crops	m Citrus trees	u Pana
f Beans	n Nut trees	v Cassava
g Cabbage	o Sugar cane	w Other root crop
h Vegetable	p Food/building tree	
i Spices	q Tobacco	

Table: 9.4
TREE CROPS IN GARDENS

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
	⟨---------- average number of trees per garden ----------⟩				
i) In cultivated gardens:					
fruit trees		0.78		0.33	0.43
citrus		0.14		0.01	0.04
nut trees		9.69		0.94	2.32
sweet banana		0.42		2.68	2.12
cooking banana		0.34		2.89	2.36
ii) In fallow of gardens:					
fruit trees		0.03		0.20	0.16
citrus		0.05			0.11
nut trees		1.31		0.69	0.83
sweet banana				6.33	4.90
cooking banana				7.06	5.36

crop type:	cleared land	tree crops	short term cash crops	food crops	many but "unknown"
	⟨---------- number of observations ----------⟩				
i) In cultivated gardens:					
fruit trees	1	36		118	1
citrus	1	37		118	
nut trees	1	32		115	8
sweet banana	1	36		114	5
cooking banana	1	37		113	5
ii) In fallow of gardens:					
fruit trees	1	31		110	14
citrus	1	37		118	
nut trees		29		101	26
sweet banana	1	35		113	7
cooking banana	1	35		113	7

9.14 Bananas, particularly cooking bananas, are an important crop, as are fruit trees and nut trees. Citrus is of lesser importance.

Chapter: 10
COCONUT AND COCOA

10.1 Coconut and cocoa have been studied in some detail before, both in the 1974-75 Sample Survey of Agriculture[5] and in the 1985 Coconut Survey[6]. Only comparative data are therefore included in the present survey.

10.2 Copra exports from Solomon Islands started in the late 19th century, rising from **1,220 MT** in 1895 to **23,000 MT** in the '20s and '30s. Following disruption during the second world war production did not achieve pre-war levels again until the 1960s. Copra production has continued to rise since, exceeding **40,000 MT** in 1984 and 1985. Following cyclone Namu copra production fell by about 20 to 25%, but showed some recovery in 1987/88.

10.3 The structure of the copra economy has varied considerably since the start of trading. Initially a smallholder crop, the plantation sector came to dominate production from 1915 onwards. Since the 1970s smallholder production has been growing by about **4.5%** annually and smallholder copra production now accounts for around **70%** of the total[8].

10.4 The area under smallholder coconuts has expanded considerably over the past 15 years, in part due to a subsidy scheme operating from 1968 to 1978 which was designed to encourage the rehabilitation, planting and replanting of coconut palms. Consequently the age structure of smallholder palms is young, with almost half the palms planted since 1970 and nearly **90%** planted since the war[8].

10.5 The total number of coconut palms in Solomon Islands is estimated to be around **9 million**, covering an area of approximately **60,000 hectares**. Table 10.1 shows the provincial breakdown of copra production, in which Western, Guadalcanal, Malaita and Central Provinces account for about **80%** of production.

10.6 The mean national copra yield is **0.72** MT per hectare according to the 1985 Coconut Survey[7]. The 1974-75 Sample Survey of Agriculture found that the average number of coconuts per palm was 36 (30 in the 1985 Coconut Survey) and assumes an average whole nut weight of **1.2kgs** with **190gm** dried copra equivalent per nut. Disciplined plantings were found to yield **40%** more per tree than customary plantings, but only **7%** more per unit area because of the greater density of customary planted trees. This result was was questioned in the 1985 Survey.

Table: 10.1
COPRA AREA AND PRODUCTION BY PROVINCE (1984)

Province	area (ha)	%	production (MT)	%	yield (MT/ha)	number of palms
Western	14,454	25	13,816	32	0.96	2,093,795
Ysabel	5,230	9	2,969	7	0.57	817,555
Central	7,909	13	9,073	21	1.15	1,287,680
Guadalcanal	12,758	22	7,324	17	0.57	1,824,790
Malaita	11,890	20	5,575	13	0.47	1,980,595
Makira	3,555	6	2,662	6	0.75	540,810
Temotu	3,032	5	1,167	3	0.38	494,420
Total	58,918	100	42,586	100	0.72	9,039,645

Source: Statistics Office, Solomon Islands (1986), Statistical Bulletin 18/86

10.7 The yield from well maintained plantations was found to be higher than from poorly maintained plantations, but the 1985 Coconut Survey attributed this to more intensive harvesting rather than the productivity of palms[5].

10.8 In the 1985 Coconut Survey soil type was classified into three broad categories. **41%** of plots lay on sand or coral; **47%** on black alluvial soils; and **21%** on red clay. It was concluded that the reason for low yields is often area specific but soil nutrient deficiency, notably potassium, is an important factor. Despite this, and high copra prices at the time, the 1974-75 survey found that "fertilizer is only applied when provided under some sort of subsidy scheme" and that "smallholder farmers will not buy fertilizer to use on their own plots. There is generally a lack of understanding of the use of fertilizer by farmers, and in many cases a reluctance to use it even when it is provided at a subsidised price"[5].

10.9 Other important factors identified in the 1985 Coconut Survey as affecting production were pests and disease. Over half the plots sampled in the 1985 suffered from Leaf Spot, which may refer to the symptoms of pest infestation or nutrient deficiency. One quarter of plots showed some evidence of White Thread, but it was felt that neither problem significantly affected output. About **40** ot **50** percent of plots were felt to be disease free[7].

10.10 Amblypelta cocophaga appeared to be a significant pest in parts of Western province, the Floridas, Guadalcanal and Malaita. 38% of households reported premature nutfall which is linked to Amblypelta in certain localities. Brontispa spp was also evident, and minor pests included rhinoceros beetle (Scapanes australis), rats, cockatoos, flying foxes and others[7].

10.11 Table 10.2 presents additional results from the present study. Coconuts are largely pure stand, although there is a case of intercropping newly planted coconut with food crops and a case of pasture under coconuts. 67% of cocoa is pure stand (4 obs) with two plots of newly planted cocoa mixed with annual crops.

Table: 10.2
COCONUTS AND COCOA

	% plots		
	coconut	cocoa	coconut + cocoa
i) Intercropping:			
Pure stand	94	67	
Intercropping with:			
Coconut + cocoa			100
Short term cash crops		17	
Food crops	3	17	
Livestock	3		
Total %	100	100	100
Number of observations (plots)	34	6	1
ii) Maintenance:			
Undercropped	3	33	
Brushed to ground level	18	50	
Brushed to shoulder height	12	17	100
Secondary bush	65		
Burnt	3		
Total %	100	100	100
Number of plots	34	6	1
iii) Coconut variety composition			
Tall	99		100
Rennel	1		
Dwarf			
Other			
Total %	100		100
Number of plots	34		1

iv) Coconut age composition

< 8 years	10	
9 - 16 years	17	
17 - 40 years	59	100
> 40 years	14	
senescent		
Total %	100	100
Number of plots	34	1

v) Cocoa age composition

< 3 years	69	
3 - 5 years	28	100
6 - 25 years	3	
> 25 years		
Total %	100	100
Number of plots	6	1

vi) Cocoa shade

coconuts		100
planted shade		
natural shade		
planted and natural	100	
Total %	100	100
Number of plots	5	1

10.12 The coconut survey of 1985 found that the average spacing of 7.5metres for palms was not significantly different between triangular and square planted plots. On customary plantings there was a wide variation in planting density, but the majority of plots were similar to disciplined plantings[7].

10.13 The 1974-75 sample survey of agriculture found that more than half of all immature palms were well maintained. Among bearing trees more than 60% of disciplined plantings were well maintained compared to 47% of customary planted palms[5]. The 1985 coconut survey found lower management standards, and that even with 30% of farmers hiring workers to assist with maintenance only 39% of plots were well brushed. 47% revealed weed growth to shoulder height, and 13% of plots were totally neglected[7]. The relationship between levels of maintenance, yield and soil conditions was not established in the 1985 survey.

10.14 Maintenance levels from the present survey are summarised in table 10.2. 65% of coconut plots have reverted to secondary bush. Such plots are often brushed again and brought back into production, but their current productivity is low. Maintenance levels are illustrated in diagram 10.1.

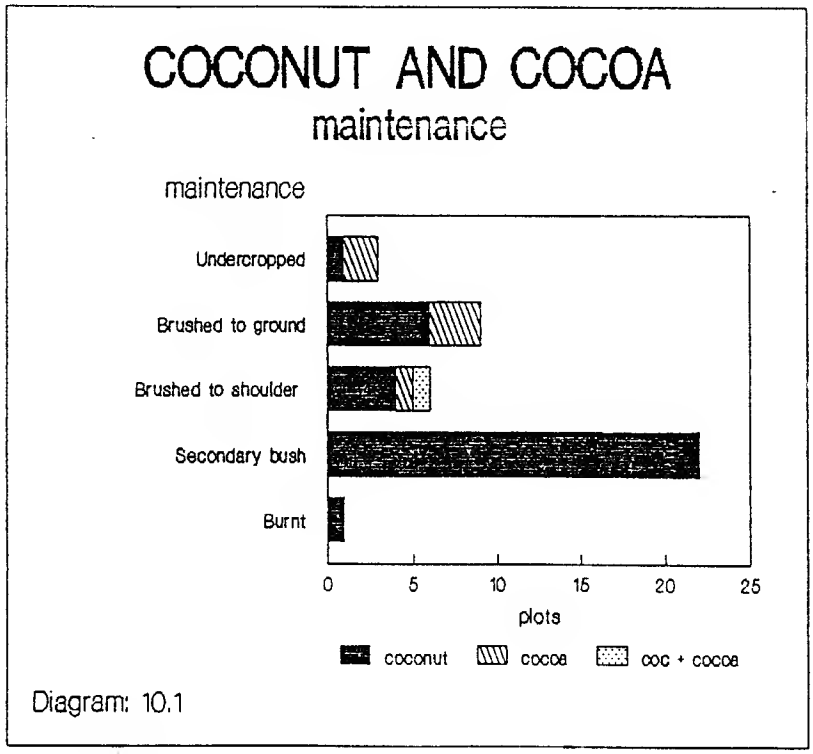


Diagram: 10.1

10.15 In the survey area coconut varieties are almost entirely local tall. **27%** are less than 16 years of age and **59%** are in the age band 17-40 years. **10%** are pre-bearing age and **14%** are older than 40 years of age.

10.16 There are few cocoa observations, but are mostly of pre-bearing or young in age, one plot under coconut shade but the remaining five plots under natural or other planted shade.

Chapter: 11
FALLOW

11.1 Throughout Solomon Islands almost all gardens are cultivated according to a form of shifting cultivation with bush fallow. In the 1974-75 Sample Survey of Agriculture it was found that, where population density or land tenure problems have restricted the availability of suitable land, the length of fallow may be reduced from the optimum 7 to 20 years to as little as one or two years. In such areas soil fertility becomes depleted through over frequent cropping[5].

11.2 Research in Solomon Islands has shown that soils are low to very low in potassium. The geology of the country is composed in the main of rocks which are low in potassium minerals, and potassium is readily leached from soil under conditions of continuously high rainfall and rugged topography. Fallow is essential for the restoration of potassium fertility: "Under traditional shifting cultivation the depletion of potassium by crops is gradually reversed over a period of 3-15 years or more by a combination of mineral weathering and root systems incorporating potash in the nutrient cycle". Although burning leads to an erratic distribution of potassium in the topsoil, "the burning of vegetative trash is beneficial and it has been shown that topsoil potassium is increased by as much as 100% on average after burning, all of this increase being held by the exchange complex"[9].

11.3 Research on Malaita has shown that the average tuber yield of sweet potato is **9.3t/ha** on sites of more than 10 years of fallow, falling off rapidly to **6.0t/ha** on land of 5 - 9 years of fallow; **4.8t/ha** on land of 0 - 4 years of fallow; and **3.5t/ha** on successively cropped land. A residual yield of 2 - 6t/ha "seems to represent the rate of release of potassium from slowly available reserves in soil and weathering parent material within rooting depth". Large amounts of fertiliser are required to restore yields. A supply of 112kg/ha K is only marginally beneficial and inadequate to replenish the rate of potassium removal by the crop. 200 to 300kg/ha K is said to be required to restore yields to levels commensurate with long fallow periods[9].

11.4 Phosphorus varies widely in its total and available forms, but Solomon Islands soils generally have low levels in the subsoil and medium levels of total phosphorus in the topsoil. Most soils used for agriculture have satisfactory levels of phosphorus but as land pressure increases deficiencies may become more widespread. Humus in the topsoil is accompanied by an increase in phosphorus, mainly in organic form, which may become readily available [9].

11.5 Soil total nitrogen levels are generally adequate, with C:N ratios in the range 7-13 signifying the ready availability of nitrogen. Topsoil nitrogen is dependent on land use and in particular the length of fallow since there is a build-up of topsoil nitrogen under secondary regrowth. Sulphur is similarly associated with organic matter, and is higher under forest than under burned grassland [9].

11.6 There is a close relationship between pH and organic matter. The lower the pH the greater the surface organic matter and the higher the subsoil organic carbon content. Difficulties associated with low pH such as aluminium toxicity are only likely to be widespread in the New Georgia group and possibly Ysabel. Alkaline soils are fairly widespread and are associated with reef limestone. The chief problem induced by alkaline calcareous soils is lime induced chlorosis of foliage which results from deficiencies of iron, manganese, zinc and copper [9].

11.7 In addition there is a close relationship between soil depth and soil fertility. "All stable sites tend to favour an accumulation of maximum weathered material due to minimal losses by surface erosion. Thus there arises the paradox that on stable hill sites and terraces the soils tend to be deepest but least fertile, while on adjacent steep slopes the soils are relatively unweathered, and hence fertile, but shallow" [9].

11.8 The shifting system of smallholder agriculture in Solomon Islands is suited to the environment and prevailing management. Soil fertility is restored during fallow periods, and small isolated areas of mixed cropping are not conducive to pest build-up. Burning of surface vegetative trash not only releases a flush of nutrients, of which the most important is potassium, but is also a useful phytosanitary measure which destroys weed seeds, some insects and undesirable pathogens [9].

11.9 An analysis of fallow therefore tells much about the dynamics of smallholder agriculture, and likely pressures on farming systems. Hansell and Wall[10] state that "there is little doubt that the major factor influencing the decision to abandon the garden is the decline in crop productivity but the exact causes of the decline are not fully understood". The greatest decline in production is between the first and second crops, rather than between the second and subsequent crops. They estimate that despite reduced yields there is still a good return from a low input of labour and conclude that reduced yields alone is insufficient reason for the abandonment of a garden. An important consideration may be the build-up of soil-borne plant diseases causing the rotting of corms or tubers, insect attack and weed infestation[10].

11.10 In the 1974-75 Sample Survey of Agriculture[5] it was stated that, while in overall terms Solomon Islands cannot be said to be suffering from land pressure, it may occur in some areas. Table 11.1 shows the distribution of garden land by the length of the bush fallow in 1975.

Table: 11.1
LENGTH OF BUSH FALLOW (1975)

length of bush fallow (years)	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
	% observations				
< 2	23	6	17	16	14
2 - 4	20	5	33	14	18
5 - 7	4	11	25	12	15
8 - 10	10	10	8	15	10
> 10	13	20	3	14	13
never previously cultivated	29	48	15	29	32
Mean length fallow (years)	5.6	9.2	4.5	6.7	6.4

Source: Statistics Office (1978), 1974-75 Agricultural Statistics Survey

11.11 Table 11.2, also from the 1974-75 survey, shows the distribution of garden land by length of cultivation.

Table: 11.2
LENGTH OF CULTIVATION (1975)

length of cultivation (months)	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
	% observations				
< 4	20	45	11	19	27
4 - 6	62	31	36	22	37
7 - 9	12	13	25	33	19
10 - 12	5	8	14	18	10
> 12	2	4	14	8	7
Mean cultivation (months)	5.1	4.7	7.6	7.2	6.0

Source: Statistics Office (1978), 1974-75 Agricultural Statistics Survey

11.12 In 1975 it was found that 32% of gardens in Solomon islands had never been previously cultivated, and that the average length of bush fallow of cultivated gardens was 6.4 years. Only 7% of gardens were generally cultivated for more than 12 months before reverting to fallow, and the average length of cultivation of food gardens was 6 months.

11.13 Table 11.3 summarises cropping intensity in the survey area. The crop period is shown in the first column, which is the time from planting to harvest for the named crop.

11.14 The second column describes the number of times an area is cropped in sequence before reverting to fallow. This introduces complexity since the crop type may, and commonly does, change within the sequence. Thus yam will commonly be followed by sweet potato, which may be followed later by cassava. The table therefore shows different stages in the cropping sequence. The dominant crops are pana and yam with 117 observations and sweet potato with 62 observations. A typical root cropping sequence is then:

pana/yam	8 months
pana/yam	8 months
sweet potato	4 months
cropped once again or abandoned	

Table: 11.3
CROPPING INTENSITY

crop type		harvest to harvest (months)	number of crops in sequence	number of cases (obs)
all crops		6.3	3.0	240
cleared land	a	8.0	2.4	9
coconut	b	5.2	na	37
cocoa	c	2.4	na	8
fruit crops	j		3.0	1
nut trees	n	3.0	1.5	2
sweet potato	r	4.2	3.3	62
yam	t	8.0	3.3	27
pana	u	7.6	3.2	90
cassava	v	7.5	3.3	4

Note: "na" = not applicable

11.15 Table 11.4 describes the fallow period, however, this has little meaning for tree crops since the interpretation of fallow varies with the age of the tree crop and previous cropping history. For food crops the fallow period relies on the knowledge of the respondent. Often it is found that long fallow periods are beyond the memory of operators and these are referred to as "cases longer than memory". **62%** of gardens have such long fallows. Where the fallow period is known on food gardens there are 9.6 years of fallow between cropping.

Table: 11.4
FALLOW PERIOD (years)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
mean years of fallow		4.9		9.6	8.9
standard deviation (years)		8.6		7.0	7.4
number of cases (gardens)		9		50	59
cases longer than memory					97
total cases (gardens)					156

11.16 Fallow periods cover a range of soil and site conditions, and are themselves variable. Table 11.5 shows that 55% of fallow periods on food gardens are longer than memory (and 52% on tree crop gardens). Some intensive cropping does take place, but fallow periods are generally long.

Table: 11.5
FALLOW RANGE

i) Fallow Range by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no fallow		5		2	7
1 year		1		2	3
2 years				5	5
3 years		1			1
4 years				7	7
5 years				3	3
6 - 10 years				11	11
11 - 20 years		2		17	19
21 - 50 years				3	3
beyond memory ("long time")	1	28		68	97
total by crop type		37		118	156

ii) Fallow Range by % area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no fallow		32		1	33
1 year		1		1	3
2 years					
3 years					
4 years				1	1
5 years				1	1
6 - 10 years				3	3
11 - 20 years		1		6	7
21 - 50 years					
beyond memory ("long time")		35		17	51
total by crop type		69		31	100

Note: The table of % area is only approximate due to rounding small numbers

11.17 That fallow periods are long can be seen in the type of fallow, shown in table 11.6.

Table: 11.6
FALLOW TYPE

i) Fallow type by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
primary forest		11		25	36
secondary forest	1	20		74	95
dense thicket				14	14
open scrub grassland		1		2	3
grassland				2	2
planted fallow		1			1
other fallow		4		1	5
total by crop type	1	37		118	156

ii) Fallow type by % area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
primary forest		10		6	15
secondary forest		28		19	47
dense thicket				3	3
open scrub grassland					
grassland				1	1
planted fallow		1			1
other fallow		31		1	32
total by crop type		69		31	100

Note: The table of % area is only approximate due to rounding small numbers

11.18 **84%** of all gardens have a fallow of primary or secondary forest, with a further **9%** under dense shrubby thicket - in total accounting for **65%** of the cropped area. Land pressure at present is relatively low in the vicinity of Hakama.

11.19 **19%** of the food garden area is cut from primary forest compared with **15%** of the tree area. Tree areas are static whereas annual cropping is constantly shifting, so that the fallow area of food gardens is relatively large with respect to the area under annual crops. Thus the encroachment of food gardens into primary forest is correspondingly large, since all fallow was originally primary forest.

Chapter: 12
LANDFORM

12.1 The survey area, among the islands of Nggela Sule and Nggela Pile, is populated mainly along the coastal margins where there is only a narrow coastal fringe. Landforms are broadly subdivided into "lowland" and "upland" where "upland" simply means above the coastal plain or coastal terrace, but does not imply high elevation.

12.2 Table 12.1 shows the distribution of cultivated land in the survey by landform. The first part of the table records the number of observations (gardens) and is expressed in area terms in the second part of the table.

12.3 **70%** of coconut gardens representing **42%** of the coconut area are on lowland sites. **30%** of coconut gardens representing **68%** of the coconut area are on upland, mainly level or gentle sloping sites.

12.4 The majority of food crop gardens are on upland sites. **88%** of food crop gardens representing **87%** of the food garden area are on upland, mostly moderately or steeply sloping, sites. **12%** of gardens representing **13%** of food garden area are on lowland sites.

12.5 A summary of the association between cropping and landform is illustrated in diagram 12.1.

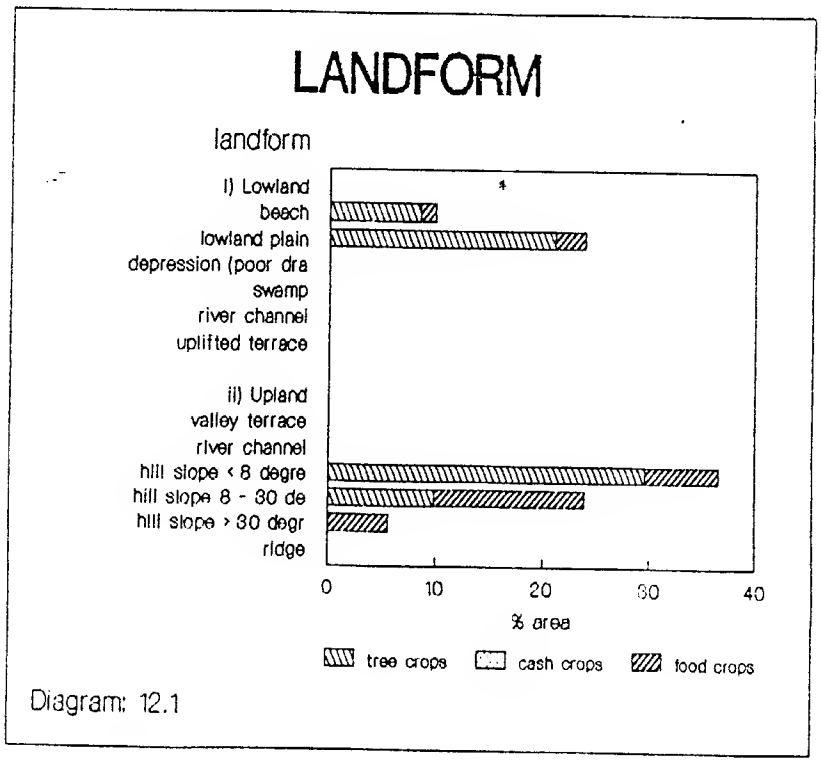


Diagram: 12.1

Table: 12.1

LANDFORM

i) Landform by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Lowland					
beach		9		2	11
lowland plain		16		8	24
depression (poor drainage)					
swamp					
river channel		1		3	4
uplifted terrace				1	1
ii) Upland					
valley terrace					
river channel					
hill slope < 8 degrees		4		31	35
hill slope 8 - 30 degrees	1	7		51	59
hill slope > 30 degrees				21	21
ridge				1	1
total by crop type	1	37		118	156

ii) Landform by % area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Lowland					
beach		8		1	10
lowland plain		21		3	24
depression (poor drainage)					
swamp					
river channel					
uplifted terrace					
ii) Upland					
valley terrace					
river channel					
hill slope < 8 degrees		30		7	37
hill slope 8 - 30 degrees		10		14	24
hill slope > 30 degrees				6	6
ridge					
total by crop type		69		31	100

Note: The table of % area is only approximate due to rounding small numbers

12.6 Table 12.2 describes the characteristics of slope in farming systems. The first part of the table records the frequency of observations (plots) which is expressed in area terms in the second part of the table.

12.7 The overall mean slope among all plots is 17 degrees. 61 plots or 25% of all plots, representing 33% of the total cultivated area, are on sites of less than 5 degrees slope. The remainder range from 5 degrees to over 30 degrees.

12.8 Coconuts and cocoa are mostly on level sites, with a mean slope of 4 degrees for coconuts.

12.9 Food plots are also predominantly on level or gently sloping sites, but many are on steep sites. The mean slope of sweet potato plots is 14 degrees. 61% of sweet potato plots (38 plots), representing 66% of the sweet potato area, are on sites of less than 10 degrees of slope. The remainder range from 10 to over 30 degrees of slope.

12.10 Yam plots have a mean slope of 29 degrees. Many small plots are on steep sites, but in area terms yams are mostly on sites of 5 to 10 degrees.

12.11 The area cultivated to pana is large. The mean slope of pana plots is 23 degrees, with 51% of pana plots representing 53% of the pana area on slopes of greater than 20 degrees.

12.12 Fruit trees and nut trees representing a small proportion of the total cultivated area, are on flat to gently sloping sites of less than 5 degrees slope.

Table: 12.2
SLOPE

i) Slope by number of observations 'plots'

crop type		mean slope (degrees)	frequency of plots at different degrees of slope						frequency of crops
			0 - 5 degrees	5 - 10 degrees	10 - 20 degrees	20 - 30 degrees	30 - 50 degrees	> 50 degrees	
all crops (total)		17	61	63	38	40	36	2	34
cleared land	a	13	4	1	2	1	1		
coconut	b	4	25	8	3	1			3
cocoa	c	1	7	1					
fruit crops	j	5	1						
nut trees	n		2						
sweet potato	r	14	16	22	9	8	7		6
yam	t	29	1	7	5	2	11	1	
pana	u	23	5	20	19	28	17	1	9
cassava	v	9		4					

ii) Slope by % area of holding

crop type		frequency of plots at different degrees of slope						frequenc of crops
		0 - 5 degrees	5 - 10 degrees	10 - 20 degrees	20 - 30 degrees	30 - 50 degrees	> 50 degrees	
all crops (total)		33	46	10	7	4		10
cleared land	a							
coconut	b	23	39	4				6
cocoa	c	4						
fruit crops	j	1						
nut trees	n							
sweet potato	r	3	3	1	1			
yam	t		1			1		
pana	u	1	3	4	6	3		1
cassava	v							

Note: The table of % area is only approximate due to rounding small numbers

12.13 Table 12.3 summarises conservation measures. There is only one occurrence of contour cultivation, in which alley cropping was practiced in a food garden. In general there are no conservation measures practiced. In the survey area fertility is maintained by long fallow periods and there is no visible evidence of erosion due to cropping.

Table: 12.3
CONSERVATION AND ALLEY CROPPING

i) Conservation by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Conservation none contour cultivation bunding terracing	1	37		118	156
ii) Alley cropping not performed performed	1	37		118	156
total by crop type	1	37		118	156

ii) Conservation by % area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Conservation none contour cultivation bunding terracing		69		31	100
ii) Alley cropping not performed performed		69		31	100
total by crop type		69		31	100

Note: The table of % area is only approximate due to rounding small numbers

12.14 A further aspect of "landform" is the spatial distribution of gardens. Diagrams 12.2 to 12.4 illustrate the relationships between crop type, crop area and the distance of gardens from households.

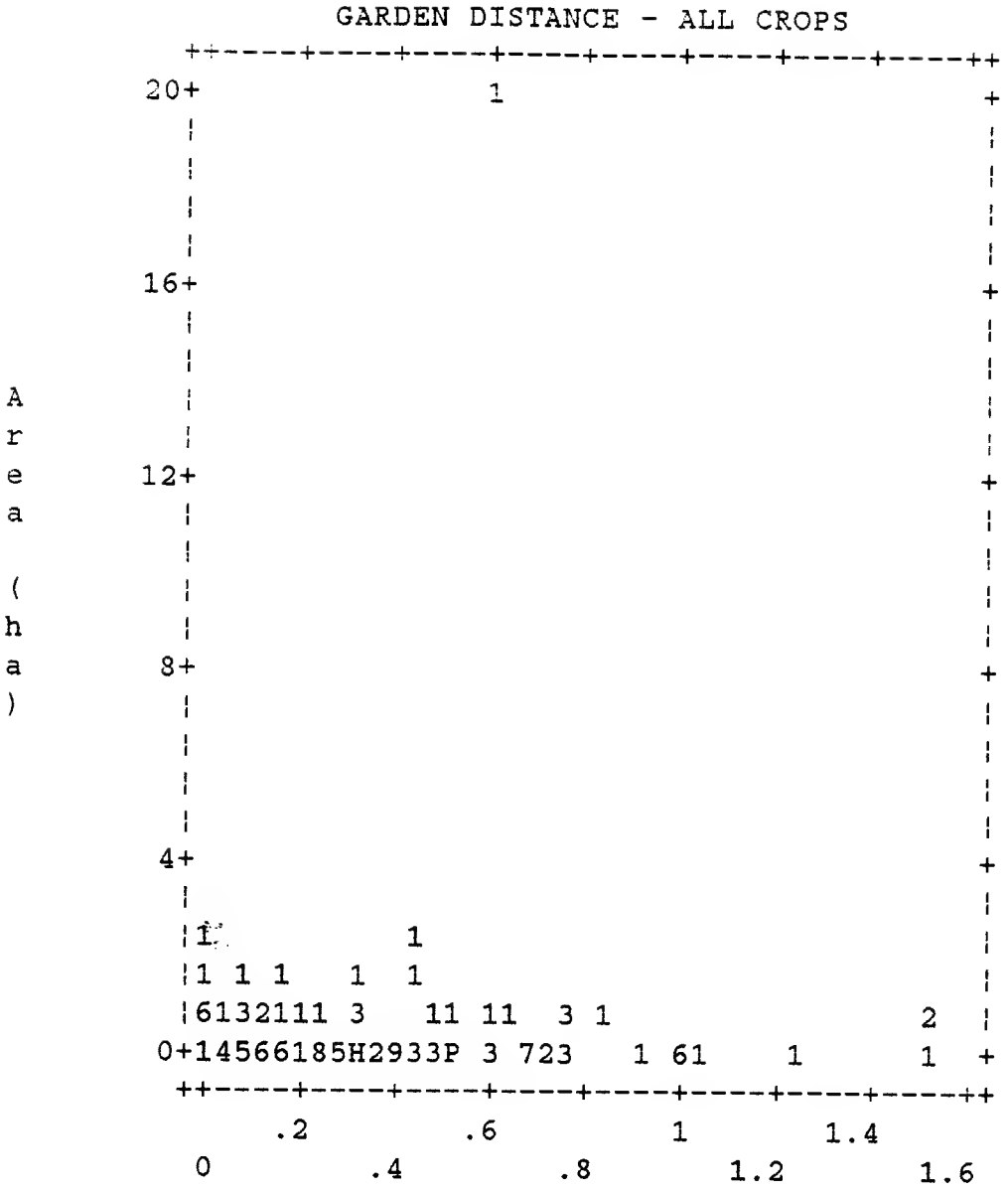
2.15 Diagram 12.2 is the graph of gardens for all crops, while subsequent diagrams show the distance relationships for the major crop types. The graph shows the relationship between garden area (vertical axis) and the time taken to reach the garden from the household (horizontal axis). Graph entries represent the number of observations (gardens) and are numbered from 1 to 9 and thereafter alphabetically. Thus where points coincide the number of points is shown: 9 occurrences is recorded as "9"; 10 occurrences as "A"; 13 occurrences as "D"; and so on.

12.16 The overall mean time taken to reach gardens is .264 hours, or about 16 minutes, with a maximum time recorded as 1.30 hours. Garden size tends to be fairly uniform irrespective of distance from the household.

12.18 Diagram 12.3 shows the same information, but this time for tree crop gardens. The mean time taken to reach tree crop gardens from the household is .158 hours, with a maximum recorded time of 1.00hrs.

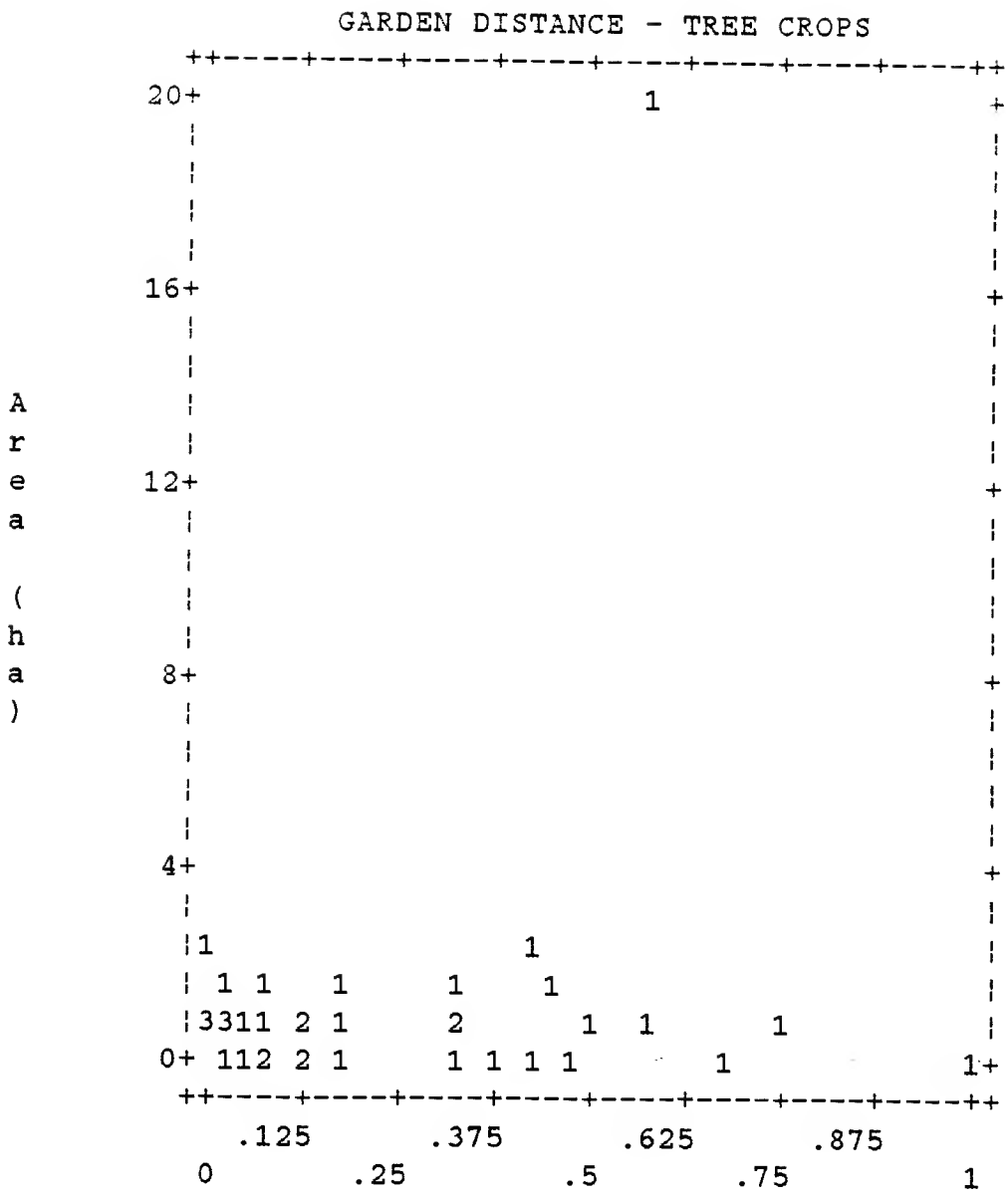
12.19 There is no relationship between garden area and distance from the household in diagram 12.5. The mean time taken to reach food gardens from the household is .297 hours, with a maximum time of 1.30 hours.

Diagram: 12.2



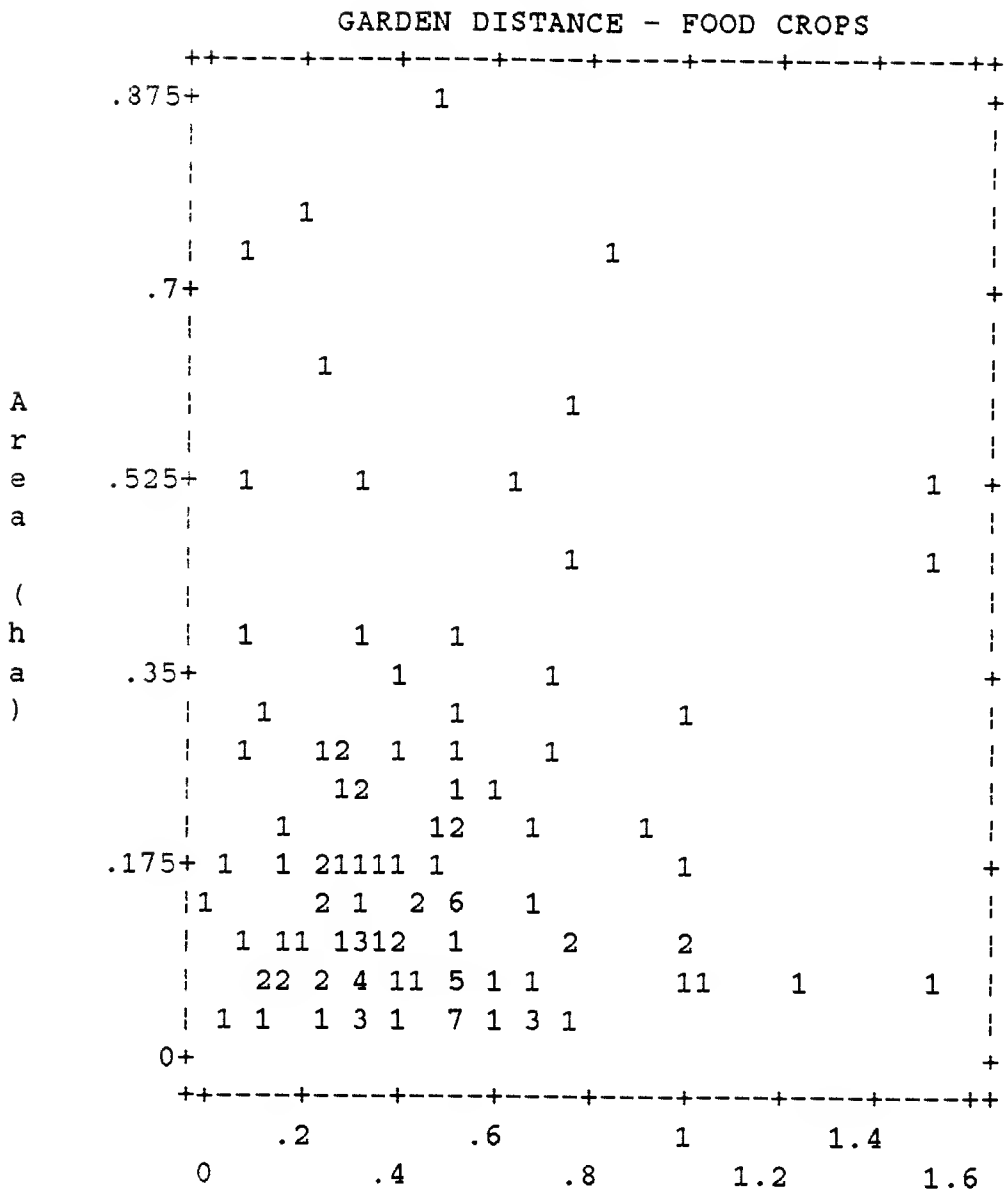
Mean = .264 hrs
Max = 1.30 hrs
Number of observations (gardens) = 156

Diagram: 12.3



Mean = .158 hrs
Max = 1.00 hrs
Number of observations (gardens) = 37

Diagram: 12.4



Mean = .297 hrs
Max = 1.30 hrs
Number of observations (gardens) = 180

Chapter: 13
ADVERSE FACTORS AFFECTING PRODUCTION

13.1 Table 13.1 describes site factors which farmers regard as problems. The first part of the table specifies the number of observations (gardens), which is expressed as the proportion of cultivated area affected in the second part of the table.

Table: 13.1
SITE CONDITIONS

i) Site Conditions by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no site limitation	1	8		88	97
poor soil/site		3		9	12
pest/disease problem		5		8	13
poor site + pests		1		3	4
weed problem		12		4	16
weeds + poor site		3		1	4
weeds + pests		5		5	10
weeds + site + pests					
total by crop type	1	37		118	156

ii) Site Conditions by % cultivated area affected

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no site limitation		7		21	28
poor soil/site		1		3	4
pest/disease problem		8		3	11
poor site + pests		1		1	3
weed problem		15		1	17
weeds + poor site		3		1	4
weeds + pests		32		1	33
weeds + site + pests					
total by crop type		68		32	100

Note: The table of % area is only approximate due to rounding small numbers

13.2 62% of all gardens (97 gardens) but representing only 28% of the cultivated area have no site limitations. Thus problems are encountered on 72% of the cultivated area. Site problems may be summarised by grouping the main factors as follows:

	% gardens	% area
No site limitations	62	28
Poor soil/site	13	11
Pests/disease	27	47
Weeds	30	54

13.3 The major problem is weeds affecting 54% of the cultivated area, although pests and disease also affect 47% of the cultivated area, and 11% of the cultivated area suffers from poor soils or site factors. Site conditions are illustrated in diagram 13.1 showing that tree crop management encounters major problems, of which weeds are dominant, but also that poor soil and pest and disease problems affect large areas. 78% of tree crop plantings are affected by problems on 90% of the tree crop area.

13.4 Food crops show fewer problems, affecting 25% of food gardens but 34% of the food crop area. Poor soils or site factors, pests and disease are the dominant problems affecting root crops.

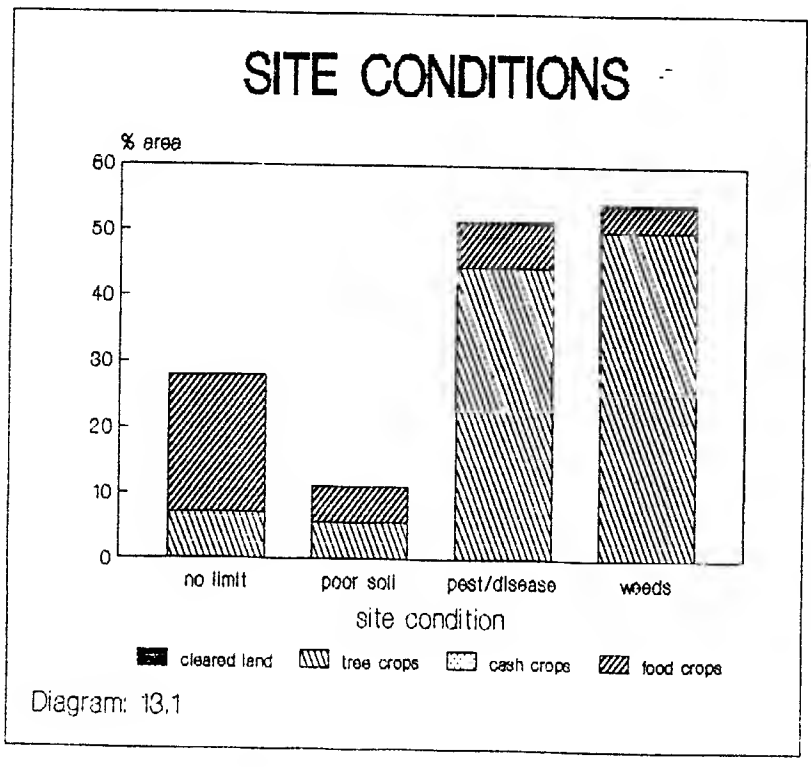


Diagram: 13.1

13.5 Table 13.2 describes physical crop damage in which **22%** of coconut stands were damaged in some way, extending over **51%** of the coconut area. The survey was undertaken towards the end of a prolongued drought which caused stress in all crops. This resulted in poor development of annual crops which required repeated planting. Coupled with this, damage to food gardens from marauding wild pigs was severe. **45%** of food crop gardens were affected by drought and related factors, extending over **50%** of the food garden area.

Table: 13.2
CROP DAMAGE

i) Crop Damage by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no damage	1	29		65	95
cyclone damage					
other damage (drought)		8		53	61
cyclone and other damage					
total by crop type	1	37		118	156

ii) Crop Damage by % area of holding

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no damage		34		15	49
cyclone damage					
other damage (drought)		35		15	51
cyclone and other damage					
total by crop type		69		31	100

Note: The table of % area is only approximate due to rounding small numbers

13.6 Table 13.3 describes insect damage to crops. The first part of the table shows the frequency of plots on which damage was encountered, and is expressed in area terms in the second part of the table. The nature of damage is described in main columns by the part of the crop affected - which may be leaves, fruits or roots - each subdivided into severity of damage observed on the standing crop. To the right of the upper table, "frequency of plots" shows the total number of plots observed, including those for which there is no damage. The first row of each table summarises damage across all crops.

Table: 13.3
INSECT CROP DAMAGE

i) Insect Damage by frequency of damage encountered (plots)

part affected:		leaves		fruits				frequency of plots
extent of damage:		little	consid-erable	little	consid-erable	severe	crop devastated	
all crops (total)		11	2	12	7	10	1	240
cleared land	a							9
coconut	b		2	9	4	8	1	37
cocoa	c							8
fruit crops	j							1
nut trees	n							2
sweet potato	r	4		6	3	2		62
yam	t			1				27
pana	u	6		5	1			90
cassava	v	1		1				4

Note: 'Fruits' on root crops refer to tubers

ii) Insect Damage by % area affected

part affected:		leaves		fruits			
extent of damage:		little	consi-derable	little	consid-erable	severe	crop devastated
all crops (total)		1	4	10	6	36	1
cleared land	a						
coconut	b		4	10	6	36	1
cocoa	c						
fruit crops	j						
nut trees	n						
sweet potato	r						
yam	t						
pana	u	1					
cassava	v						

Note: The table of % area is only approximate due to rounding small numbers

13.7 The most extensive damage is to coconuts, in which **65%** of stands (24 plots) show varying levels of insect damage affecting leaves and nuts, and extending over **83%** of the coconut area (57% of the total cultivated area). Scattered damage is seen on root crops where insect damage to leaves and fruits affects small areas.

13.8 Table 13.4 is the corresponding table for disease damage.

Table: 13.4
DISEASE CROP DAMAGE

i) Disease Damage by frequency of damage encountered (plots)

part affected:		leaves	fruits	roots		frequency of crops
extent of damage:		little	little	little	consid-erable	
all crops (total)		7	9	4	1	240
cleared land	a					9
coconut	b	3	7			37
cocoa	c	1				8
fruit crops	j					1
nut trees	n					2
sweet potato	r			1	1	62
yam	t	1				27
pana	u	1	2	2		90
cassava	v	1		1		4

ii) Disease Damage by % area affected

part affected:		leaves	fruits	roots	
extent of damage:		little	little	little	consid-erable
all crops (total)		6	7		
cleared land	a				
coconut	b	6	7		
cocoa	c				
fruit crops	j				
nut trees	n				
sweet potato	r				
yam	t				
pana	u				
cassava	v				

Note: The table of % area is only approximate due to rounding small numbers

13.9 The main disease damage in area terms is to coconuts, where 19% of the coconut area (13% of the total cultivated area) shows leaf and nut damage. There are scattered occurrences of disease damage to root crops affecting small areas.

13.10 Fire, flood and wind damage are together described in table 13.5 where, of course, the "part of crop affected" no longer applies.

Table: 13.5
FIRE, FLOOD AND WIND CROP DAMAGE

i) Damage by frequency of damage encountered (plots)

part affected:		fire	flood	wind		frequency of crops
extent of damage:		considerable	(no damage)	little	considerable	
all crops (total)		1		3	2	39
cleared land	a					1
coconut	b	1				26
cocoa	c				2	2
fruit crops	j					2
nut trees	n					1
sweet potato	r			1		1
yam	t					3
pana	u			2		1
cassava	v					2

ii) Damage by % area affected

part affected:		fire	flood	wind	
extent of damage:		considerable	(no damage)	little	considerable
all crops (total)		1		1	
cleared land	a				
coconut	b	1			
cocoa	c				
fruit crops	j				
nut trees	n				
sweet potato	r				
yam	t				
pana	u			1	
cassava	v				

Note: The table of % area is only approximate due to rounding small numbers

3.11 There is fire damage on only one coconut stand and some minor wind damage to root crops. More significantly, cocoa plots showed considerable wind damage.

13.12 Rat and bird damage are similarly described in table 13.6.

Table: 13.6
RATS AND BIRDS CROP DAMAGE

i) Damage by frequency of damage encountered (plots)

part affected:		rats	birds				frequency of crops
extent of damage:		little	little	considerable	severe	crop devastated	
all crops (total)		5	2	1	2	1	240
cleared land	a						9
coconut	b			1	1	1	37
cocoa	c						3
fruit crops	j						1
nut trees	n						2
sweet potato	r	3	1				62
yam	t						27
pana	u	2	1				90
cassava	v				1		4

ii) Damage by % area affected

part affected:		rats	birds				
extent of damage:		little	little	considerable	severe	crop devastated	
all crops (total)		1		1	3	1	
cleared land	a						
coconut	b			1	3	1	
cocoa	c						
fruit crops	j						
nut trees	n						
sweet potato	r						
yam	t						
pana	u	1					
cassava	v						

Note: The table of % area affected is only approximate due to rounding small numbers

13.13 Bird damage is seen mostly on coconuts, with stattered occurrences of rat and bird damage to root crops.

13.14 Damage due to bats and livestock is described in table 13.7.

Table: 13.7
BATS AND LIVESTOCK DAMAGE

i) Damage by frequency of damage encountered (plots)

part affected:		bats		livestock				
extent of damage:		considerable	severe	little	considerable	severe	crop devastated	frequency of crops
all crops (total)		2	1	5	10	1	5	240
cleared land	a							9
coconut	b	2						37
cocoa	c							3
fruit crops	j							1
nut trees	n							2
sweet potato	r			2	7	1	3	62
yam	t			1	1			27
pana	u			2	2		2	90
cassava	v		1					4

Note: Livestock damage refers to wild pigs.

ii) Damage by % area affected

part affected:		bats		livestock			
extent of damage:		considerable	severe	little	considerable	severe	crop devastated
all crops (total)		3			1		
cleared land	a						
coconut	b	3					
cocoa	c						
fruit crops	j						
nut trees	n						
sweet potato	r				1		
yam	t						
pana	u						
cassava	v						

Note: The table of % area is only approximate due to rounding small numbers

13.15 Damage is mostly from livestock on food gardens, where many root crop gardens are damaged by wild pigs. 13 sweet potato plots, 21% of all sweet potato plots, were damaged by wild pigs. Yam and pana were also affected.

13.16 Some human damage to coconuts was evident, but a considerable amount of damage to food gardens resulted from prolongued drought and related factors. Damage is summarised in table 13.8.

Table: 13.8
HUMAN AND OTHER DAMAGE

i) Damage by frequency of damage encountered (plots)

part affected:		other damage				human			frequency
extent of damage:		little	consid-erable	severe	crop devastated	little	consid-erable	crop devastated	of crops
all crops (total)		50	52	2	20	2	1	1	240
cleared land	a								9
coconut	b		3			2	1	1	37
cocoa	c		3						3
fruit crops	j								1
nut trees	n								2
sweet potato	r	13	20	1	13				62
yam	t	8	4		3				27
pana	u	27	21	1	4				90
cassava	v	2	1						4

ii) Damage by % area affected

part affected:		other damage				human		
extent of damage:		little	consid-erable	severe	crop devastated	little	consid-erable	crop devastated
all crops (total)		7	10		1	1	1	1
cleared land	a							
coconut	b		4			1	1	1
cocoa	c							
fruit crops	j							
nut trees	n							
sweet potato	r	1	3		1			
yam	t	1						
pana	u	4	3					
cassava	v							

Note: The table of % area is only approximate due to rounding small numbers

13.17 **76%** of sweet potato plots, **56%** of yam plots, **59%** of pana plots and **75%** of cassava plots were affected by drought extending over **13%** of the cultivated area, or **41%** of the food garden area.

13.18 Table 13.8 describes crop management and the application of chemical inputs.

Table: 13.9
MANAGEMENT AND APPLICATION OF AGRICULTURAL INPUTS

i) Inputs by frequency of use (plots)

crop type		row planting	fert-iliser	pest-icide	manure	ash	other	frequency of crops
all crops (total)		32	1	3			2	240
cleared land	a							9
coconut	b	20	1					37
cocoa	c	8						8
fruit crops	j							1
nut trees	n	2						2
sweet potato	r	1		2			1	62
yam	t							27
pana	u	1		1				90
cassava	v						1	4

ii) Inputs by % area applied

crop type		row planting	fert-iliser	pest-icide	manure	ash	other
all crops (total)		54	1				
cleared land	a						
coconut	b	50	1				
cocoa	c	4					
fruit crops	j						
nut trees	n						
sweet potato	r						
yam	t						
pana	u						
cassava	v						

Note: The table of % area is only approximate due to rounding small numbers

13.19 Row planting is practiced on coconuts and cocoa. There is only one case of fertiliser application in which Muriate of Potash (Potassium Chloride) was applied to coconuts. Pesticide was applied to three root crop plots and in two cases a mix of chilli and kerosene was sprayed on root crops to control worm infestation.

Chapter: 14
CROP YIELDS

14.1 Production data on smallholder agriculture are scarce, largely due to practical difficulties associated with measuring yields in complex cropping systems that lack clear temporal and spatial boundaries. Smallholder agriculture is a continuous process in which there is little seasonality, so that any or all stages of crop growth and management operations may be exhibited at any time, with crops commonly harvested selectively over time. Table 14.1 summarises the planting characteristics of smallholder crops in the survey area.

Table: 14.1
CROP VARIETY AND SPACING

crop type		number of observations	% improved	spacing (% obs) customary	regular	recommended tree crops triangular	recommended tree crops square
Cleared	Cleared land	10					
Coconut/Cocoa	Coconuts	40	8	48	25	10	18
	Cocoa	9	100			33	67
Ground crops	Grain crops	9		100			
	Beans	4	25	100			
	Cabbage	15		93	7		
	Vegetable	4		100			
	Chilli	4		100			
	Fruit Crops	25		100			
Tree/other crops	Fruit trees						
	Banana	64		95	5	2	
	Citrus trees						
	Nut trees	5		60	40		
	Sugar cane	6		83	17		
	Food/building tree						
	Tobacco	7		100			
Root crops	Sweet potato	82	5	100			
	Taro Common	12		100			
	Giant	15		100			
	Hong Kong	7		100			
	Swamp						
	Yam	68		97	3		
	Pana	119	1	99	1		
	Cassava	53		98	2		
	Other root crop	1		100			
Total		559					

14.2 The second column refers to the introduction of non-traditional planting material, either through extension or research, or from other sources. Most crops are "traditional" with the notable exception of cocoa.

14.3 For non-tree crops there are three types of spacing identified, being "customary", "regular" and "recommended". "Customary" means there is no discernable order in the plot. "Regular" means planting according to a visible pattern, such as in rows. "Recommended" refers to the adoption of recommended practices, which may not necessarily be "regular". For tree crops there are four categories of "customary", "regular", "triangular" and "square". "Customary" and "regular" follow the same rules as non-tree crops. "Triangular" and "square" equate with recommended practices for coconuts.

14.4 In the survey area **48%** of coconuts were planted according to "custom", without discernable order. **28%** were planted either square or triangular, with the remaining **25%** showing some order but not according to established recommendations. Other crops, with the exception of cocoa, are mostly planted according to custom.

14.5 Crop mixtures in smallholder farming systems are complex, as seen in table 9.3. Table 14.2 describes something of the the complexity of planting densities. **83%** of coconut and **78%** of cocoa stands are monocropped, but complexity is exhibited in annual and other tree crops where there is little planting of pure stand crops. **34%** of sweet potato plots are upwards of 90% dominant or pure stand. A similar pattern, but at lower densities, is seen in yam and pana plots where only **4%** of yam and **16%** of pana are pure stand. Cassava, a minor crop, is generally planted as a small proportion of mixtures.

Table: 14.2
CROP DOMINANCE IN MIXTURES

crop type		number of observations	% dominance in mixture									
			0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
Cleared	Cleared land	10										
Coconut/Cocoa	Coconuts	40		3		3	3	3		3	5	83
	Cocoa	9						22				78
Ground crops	Grain crops	9	33	56		11						
	Beans	4	100									
	Cabbage	15	100									
	Vegetable	4	100									
	Chillie	4	100									
	Fruit Crops	25	76	12	8							4
Tree/other crops	Fruit trees											
	Banana	64	81	17	2							
	Citrus trees											
	Nut trees	5	40		20		20					20
	Sugar cane	6	83	17								
	Food/building tree											
	Tobacco	7	86	14								
Root crops	Sweet potato	82	6	9	9	1	6	10	6	11	9	34
	Taro Common	12	50	42	8							
	Giant	15	60	40								
	Hong Kong	7	100									
	Swamp											
	Yam	68	3	19	22	21	18	9	1	1	1	4
	Pana	119	4	4	8	13	14	18	8	12	3	16
	Cassava	53	49	28	9	4	8		2			
	Other root crop	1	100									
Total		559										

14.6 A visual assessment of yields is presented in table 14.3.

Table: 14.3
CROP PRODUCTION

crop type		number of observations		yield appearance (% obs)		
		total	zero yield (or not mature)	low	moderate	high
Cleared	Cleared land	10				
Coconut/Cocoa	Coconuts	40	6	53	47	
	Cocoa	9	5	50	25	25
Ground crops	Grain crops	9	5	25	25	50
	Beans	4		50	25	25
	Cabbage	15	5	60	40	
	Vegetable	4	1	67	33	
	Chilli	4	2	100		
	Fruit Crops	25	5	35	45	20
Tree/other crops	Fruit trees					
	Banana	64	20	27	66	7
	Citrus trees					
	Nut trees	5	1	50	50	
	Sugar cane	6	2	50	50	
	Food/building tree		1			
	Tobacco	7		43	57	
Root crops	Sweet potato	82	17	18	72	9
	Taro Common	12	6		100	
	Giant	15	6	22	78	
	Hong Kong	7		43	43	14
	Swamp					
	Yam	68	24	2	75	23
	Pana	119	36	6	73	20
	Cassava	53	14	18	72	10
	Other root crop	1		100		
Total		559	156	=	28 % zero or not mature	

Note: Yield appearance is the % of crop observations which are not devastated and close to harvest

14.7 Most yield observations are "moderate" but with a high proportion of low yields as a result of the drought. Coconuts are mostly low to moderate yielding, with **53%** low and **47%** moderate. Cocoa for the most part is in young stands and therefore is not bearing fully. Vegetable crops are low to moderate yielding, as are root crops. Yam and pana, which tend to be planted onto newly opened fertile sites, are mainly moderate to high yielding, as is cassava which is tolerant of low soil fertility and stressful conditions.

14.8 In an intensive case study of this kind it is difficult to obtain a reasonable coverage of crop yields, although these are recorded where possible in the course of the survey[12]. A crop production study has been designed to generate yield data[22] but it has not been possible to implement this yet. For the present report yields are derived from secondary sources.

a) COCONUT:

14.9 Coconut production data from the 1974-75 agricultural survey are summarised in table 14.4.

Table: 14.4
COCONUT PRODUCTION DATA FROM 1974-75 AGRICULTURAL SURVEY

	Province				Mean
	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
number of yield sites	28	32	3	30	93
coconuts per palm: disciplined	53	54	19	34	44
customary	22	36	1	41	31
mean	31	42	14	37	36
coconuts per ha : disciplined	8,194	8,983	2,822	5,773	7,178
customary	4,658	8,595	135	7,432	6,703
mean	5,794	8,753	1,926	6,492	6,913
% damaged/unusable nuts: disciplined	12	10	12	20	14
customary	19	13	36	6	13
mean	16	12	12	13	14
gross copra yield (kg/ha): disciplined	1,541	1,689	531	1,086	1,450
customary	876	1,616	25	1,398	1,261
mean	1,081	1,646	362	1,221	1,300
net yield (kg/ha): disciplined	1,356	1,520	467	869	1,247
customary	709	1,406	16	1,314	1,097
mean	908	1,448	318	1,062	1,118

Source: Statistics Office (1978) "1974-75 Agricultural Statistics Survey".
Note: Copra yields assumse 190gm dried copra per nut quoted in the Statistics Office report

14.10 In the 1974-75 agricultural survey the mean coconut yield is estimated to be **1,300kg/ha** copra equivalent, or **1,118kg/ha** when unusable nuts are discounted. The average daily consumption of coconuts was found to be **4.2** per household, resulting in a national annual consumption equivalent of **8,871MT** copra. If green nuts are taken into account it was believed[5] that the copra equivalent consumed would be **10,000MT** in a year when exports amounted to **28,000MT**.

14.11 Charles (1980) estimates lower levels of copra production with estate yields of 827kg/ha and smallholder yields of 410kg/ha The difference he attributed to a high proportion of immature plantings and the consumption of coconuts in the smallholder sector[23]. Average copra production derived from the 1985 coconut survey is estimated in the (draft) Farm Management Handbook for Solomon Islands to be 0.72MT/ha[24], although provincial yields vary from 1.15MT/ha in Central Province, which is dominated by the Levers plantation in the Russel Islands, to 0.38MT/ha in Temotu.

14.12 In conjunction with the 1985 coconut survey the Research Department of the Ministry of Agriculture and Lands has analysed the nutritient status of coconut soils soils in Solomon Islands[13]:

Coconut Soils Data:
(means of soils analyses conducted on Coconut Survey soils)

pH	N%	availalble P ppm	exchangeable K meq/100g	availalble K meq/100g
6.4	0.55	70	0.24	0.60

14.13 It was concluded that coconut soils are generally high in nitrogen, medium in phosphate, and low in potassium. Recent variety experimental results on fertilised coconuts show the following yields:

Coconut Research Results (dry copra eq kg/ha):

Site	Tenaru (Guadalcanal)		Gizo (Western)	
Year	1985	1984	1985	1984
Dwarf:Rennel Hybrid	378	2,664	1,990	1,599
Dwarf:Local Tall Hybrid	383	1,391		
Local Tall			1,839	334
Rennel	190	1,391	1,913	1,052
Mean				995

14.14 Smallholder yields in the present report are estimated to be 800kg/ha dry copra equivalent usable nuts, of which 350kg equivalent might be consumed.

b) COCOA:

14.15 Research trials on cocoa[13] from 1977 to 1985 at Black Post in Guadalcanal produced a mean dry beans yield of **1,898kg/ha** for Amelonado, 2,780kg/ha for AmlxNa33 hybrid, and **2,444kg/ha** for AmlxPa7 hybrid.

14.16 Cocoa yields from various sources are quoted in the (draft) Farm Management Handbook for Solomon Islands[24]:

Smallholder Cocoa Yields (kg/ha)[24]:

Age of tree (year)	3	4	5	6	7	8
Friend (1970)	21	126	215	220	220	173
DBSI (1983) *	150	250	600	1,200	1,450	1,450
Hiele (1988)	208	450	560	685	719	719

* unverified source

14.17 High variability in yields was attributed to differences in management, such as in the application of fertiliser, weeding, and pest and disease control.

14.18 Smallholder cocoa yields which are mainly unfertilised, are estimated in the present report to be **600kg/ha** dry beans.

c) **SWEET POTATO:**

14.19 In a study of north-west Malaita, Frazer[15] investigated the effect of fallow period on smallholder sweet potato yields. After a long fallow of 15-20 years the mean yield was found to be **14.84MT/ha** from 8 observations. After a "short" fallow of less than 10 years the mean yield was **8.99MT/ha** from 5 observations. Gollifer[16] looked at the effects of potassium and nitrogen application on annual crops on soils of the Dala Series in Malaita, soils formed on a parent material of raised coral reef and characteristically low in potassium. He found unfertilised sweet potato yields of **5.5MT/ha** (control for K) and **7.4MT/ha** (control for N). The effect of potassium application was to increase yields by up to 86%, but nitrogen tended to stimulate vine growth at the expense of the tuber.

14.20 In a series of trials at Dala, Gollifer[17] found unfertilised sweet potato yields to range widely, from around 0.25MT/ha to 24MT/ha. Yields in general were the order of 5MT/ha, which was estimated to be around half the typical North West Guadalcanal yield of 9.97MT/ha. Yield variability could not be attributed to variety or soil type, but a trend related to intensity of cropping did appear:

Effect of Recent Land History on Sweet Potato Yields (MT/ha):

land history	yield (MT/ha)
continuous cropping	3.51
0 - 4 years fallow	4.77
5 - 9 years fallow	6.03
more than 10 years fallow	9.29

Source: Gollifer (1969)

4.21 It was concluded that sweet potato and other root crops are demanding of, and remove large quantities of, potassium from the soil. A fallow-burn cycle is therefore essential to replenish soil fertility by making potassium available to shallow-rooted crops. It was considered that deep rooting trees may act as nutrient pumps, but the only practical way of shortening fallow periods was considered to be the application of potassium fertiliser[17].

4.22 Bathgate[18] found also that yields vary according to soil fertility and growing time, as well as species and density of planting. In West Guadalcanal he quotes sweet potato yields of 7.16MT/ha after 20 years of fallow and 9.36MT/ha after 8 years of fallow, but based on a single sub-plot observation only in each case.

4.23 On the weather coast of Guadalcanal Chapman and Pirie[19] studied the relationship between yields and cropping, and found yields to be high in comparison to studies elsewhere:

Sweet Potato Yield (MT/ha) - Weather Coast, Guadalcanal

successive crops	Ghauvalisi	Sughu	Hatare/Poinaho
1	41.67	18.08	17.82
2	15.31	10.54	9.79
3		10.29	9.79

Source: Chapman and Pirie (1974)

14.24 In the 1974-75 Agricultural Survey[5] the mean yield of sweet potato was 15.7MT/ha, but this was felt to be an over-estimate.

14.25 More recent research provide further information on sweet potato yields, but results exhibit considerable variability across seasons and due to other causes:

trial	yield MT/ha		notes
	gross	marketable	
improved cultivars	17.9	14.5	25 obs
control	11.2	6.7	1 obs
dry season corn intercropping	15.9	7.1	135 days to harvest
	18.5	12.0	165 days to harvest
wet season corn intercropping	5.9	1.5	135 days to harvest
	11.0	3.4	165 days to harvest
dry season weevil control	15.3		no effect from insecticide
wet season weevil control	8.19	6.37	

Source: Research Department Annual Report 1984[14] and 1985[13]

14.26 Smallholder sweet potato yields of usable crop are estimated in the present report to be 8MT/ha under long fallow of 8 years or more - falling to 5MT/ha for fallow of 4 to 8 years, and 3.5MT/ha for short fallow cropping.

d) TARO:

14.27 Taro yields in the literature are highly variable. Frazer[15] found Colocasia esculenta to yield 8.94MT/ha in North Malaita, based on 10 observations. Gollifer[16] on the Dala Series in Malaita found yields of 4.0MT/ha for unfertilised taro, which increased to 6.0MT/ha with 168kg/ka potassium fertiliser applied. Gollifer[17] also quotes widely ranging unfertilised taro yields of 1.00 to 10.80MT/ha on experimental plots. In a spacing trial in Guadalcanal at Tenaru on which fertiliser was applied, the net undamaged taro yield for densities of 2,000 to 4,000 plants/ha was around 5MT/ha, with 30% loss due to corm damage[14]. On the same site a high intensity inputs and management trial to investigate leaf blight yielded around 9MT/ha marketable corms[14]. The control yield in a 1985 taro beetle trial at Tenaru was 3.49MT/ha[13]. Tioti (1967) estimated taro yields to be 12.6MT/ha[25], but Gollifer (1970) quotes yields of 4.7MT/ha[26].

14.28 The smallholder taro yield in the present report is estimated to be **5MT/ha.**

e) **YAM:**

14.29 In North Malaita Frazer[15] found yam yields of **5.16MT/ha** for Dioscorea alata. Gollifer[17] quotes unfertilised yam yields of **6.03MT/ha** to **30.38MT/ha** at Dala experimental station on Malaita. In 1984 an experiment to compare the yields of 18 yam cultivars was conducted at Tenaru in Guadalcanal[14] in which the cultivars with high resistance to dieback yielded around **14** to **18MT/ha,** with the highest resistance cultivar yielding **24MT/ha.** Susceptible cultivars produced yields as low as **2MT/ha.** Maeinia[27] quotes very high yields of **50 - 63MT/ha** for Malaita.

14.30 Smallholder yam yields are likely to be higher than those of sweet potato given that they tend to be planted on newly opened sites and the yield appearance is generally good. In the present report long term fallow is expected to yield **10MT/ha,** fallow of 4-8 years to yield **6MT/ha** and short fallow systems to yield **4MT/ha.**

f) **PANA:**

14.31 Frazer[15] quotes a for North Malaita, where on one observation only of Dioscorea esculenta produced a yield of **11.52MT/ha.** Fertilised cultivar trials at Dodo Creek Research Station[14] in 1984 yielded **16.2MT/ha** marketable tubers out of a total yield of **27.7MT/ha.** 1983 results were higher, with **43.7MT/ha** marketable tubers out of a total yield of **52.9MT/ha.** The difference was believed to be due to inadequate fertiliser in 1984. In 1985 the mean fertilised yield of 8 cultivars was **24.3MT/ha** marketable tubers[13].

14.32 Smallholder pana yields in the present report are expected to be similar to yam yields - of **10MT/ha** under long fallow, **6MT/ha** under 4-8 years fallow, and **4MT/ha** under short fallow.

g) CASSAVA:

14.33 Fertilised cassava in a time of harvest trial at Dodo Creek in Guadalcanal[13] yielded 23.8MT/ha after 9 months and 27.8MT/ha after 12 months. In a fertilised germplasm collection trial on the Fataolo land system on Malaita 17 cultivars ranged from 7.5 to 65.8MT/ha, with 50% above 40MT/ha[28].

14.34 Smallholder cassava is generally planted on less fertile sites and is commonly a minor crop in a mixture. It is high yielding, although of low nutritional value. Smallholder yields in the present report are estimated to be 10MT/ha.

h) MAIZE:

14.35 Gollifer[16] quotes unfertilised maize yields of 1.90MT/ha on Dala soils in Malaita, but yields of 5.58MT/ha when fertilised with NPK. Further unfertilised maize yield data from Dala[17] range from 1.55MT/ha to 2.13MT/ha.

14.36 Smallholder maize yields in the present report are estimated to be 1.8MT/ha.

i) GROUNDNUT:

14.37 Gollifer quotes unfertilised groundnut yields in the range 527kg/ha to 1,278kg/ha from Dala in Malaita.

14.38 Samllholder groundnut yields in the present report are estimated to be 600kg/ha.

j) SUMMARY OF YIELDS:

14.39 Crop yields derived from secondary sources are necessarily imprecise in the present context because of the complexity of smallholder farming systems. Diverse crop mixtures, with varying crop densities and differing site conditions do not lend themselves to a simple analysis of crop yields or smallholder production. Crop yields in the literature are generally for pure stand crops, or very simple mixtures - under controlled or even modified conditions. There is then a need to study smallholder production under more realistic conditions, as is part of the on-going programme of the Agricultural Economics Section. In the meantime, a "best estimate" of typical smallholder yields in the project area is presented in table 14.5. The present season's yields are lower than these due to the drought.

Table: 14.5
SMALLHOLDER CROP YIELDS

crop	condition	yield kg/ha
coconut	copra equivalent	800
cocoa	dry beans	600
sweet potato	> 8 years fallow	8,000
	4 - 8 years fallow	5,000
	< 4 years fallow	3,500
taro		5,000
yam	> 8 years fallow	10,000
	4 - 8 years fallow	6,000
	< 4 years fallow	4,500
pana	> 8 years fallow	10,000
	4 - 8 years fallow	6,000
	< 4 years fallow	4,500
cassava		10,000
maize		1,800
groundnuts		600

14.40 In parallel with the AES farming Systems Survey the Statistics Office of the Ministry of Finance conducted a "Project Beneficiary Monitoring and Evaluation" (PBME) study on six of the sites covered by the AES survey. This makes it possible to utilise smallholder production data from the PBME exercise. Those results are discussed in chapter 15 which follows.

Chapter: 15
SMALLHOLDER PRODUCTION

15.1 Under the Rural Services "Project Benificiary Monitoring and Evaluation" undertaken by the Statistics Office, gross crop offtake and other primary production were measured. Unpublished provisional results, courtesy of the Statistics Office, are presented in table 15.1.

Table: 15.1
DAILY SMALLHOLDER PRODUCTION

Average daily production from entire household (kg):

commodity	Province and Site						
	Ysabel	Central	Guadalcanal	Malaita	Makira	Temotu	Average
	Susubona	Hakama	Marau Sound	Afio	NW Peninsula	Lata	
sweet potato	8.00	2.67	6.68	3.79	4.09	4.19	4.90
cassava	1.26	0.98	2.15	0.35	0.63	0.04	0.90
yam	0.68	1.68	0.71	2.25	0.65	0.90	1.14
pana	0.58	4.60	0.32	0.06	0.34	0.12	1.00
taro	0.71	0.32	0.45	1.60	1.37	1.15	0.93
breadfruit	0.01		0.03	0.01		0.11	0.03
banana	0.55	0.56	1.85	0.83	2.06	0.28	1.02
sub-total	11.79	10.80	12.20	8.90	9.13	6.78	9.93
coconut	0.44	0.49	3.55	1.41	2.54	0.43	1.48
cabbage	0.24	0.26	0.40	0.75	0.71	0.32	0.45
other veg	0.29	0.12	0.24	0.05	0.37	0.08	0.19
other fruit	0.91	0.31	2.01	0.89	1.90	0.41	1.07
fresh meat			0.01		0.01	0.03	0.01
fresh fish	0.69	0.40	0.57	0.32	0.25	0.12	0.39
crab/shellfish	0.58	0.20	0.13	0.23	0.02	0.05	0.20
milk/eggs	0.01				0.00		0.00
betel nut	0.09	0.08		0.16	0.06	0.11	0.08
local tobacco		0.03			0.01	0.01	0.01
Based on observations from the following number of "household days":	1,200	960	480	840	1,200	720	900

Source: Statistics Office PBME unpublished results.

15.2 On average there are **9.93kg** of staple crops produced daily, the crop composition varying according to area and season. Given a national mean household size of **6.50** from the 1986 population census this would provide each man, woman and child with approximately **1.5kg** of staple per day.

15.3 The average household daily production of cabbage is 0.45kg, other vegetables 0.19kg and fruit 1.07kg. Only 0.01kg of fresh meat is consumed daily in comparison with 0.39kg (whole) fresh fish and 0.20kg crabs and shellfish. National coconut consumption is estimated to be 1.48kg husked unshelled nuts per day, which amounts to an average consumption of 4.26 nuts per household per day according to the mean nut weights in the survey.

15.4 Results from table 15.1 are transformed into annual production in table 15.2 using the simplifying assumption that the survey period is representative of the rest of the year. This is only a first approximation of smallholder yields.

Table: 15.2
ANNUAL SMALLHOLDER PRODUCTION

Average annual production from entire household (kg):

commodity	Province and Site						
	Ysabel	Central	Guadalcanal	Malaita	Makira	Temotu	Average
	Susubona	Hakama	Marau Sound	Afio	NW Peninsula	Lata	
sweet potato	2,919	974	2,439	1,382	1,492	1,528	1,789
cassava	460	357	786	129	231	15	330
yam	247	612	260	823	236	329	418
pana	212	1,677	116	23	123	44	366
taro	259	117	163	584	501	419	341
breadfruit	3		12	4		39	10
banana	201	204	674	304	750	101	372
sub-total	4,302	3,942	4,451	3,249	3,333	2,474	3,625
coconut (kg)	159	179	1,295	515	928	156	539
(nuts)	667	621	1,864	1,508	4,088	427	1,626
cabbage	88	94	145	274	261	117	163
other veg	107	43	87	17	136	28	70
other fruit	331	112	735	325	692	150	391
fresh meat			3		4	10	3
fresh fish	250	145	208	117	90	44	142
crab/shellfish	211	72	49	86	7	19	74
milk/eggs	2				0		0
betel nut	34	27		57	20	41	30
local tobacco		9			4	3	3

15.5 From table 9.2 the average root crop area in the survey area is **0.379ha** of which pana is dominant on **0.212ha**, sweet potato on **0.107ha**, yam on **0.051ha** and cassava on **0.009ha**. These crops occur in complex mixtures, so that simple cropping patterns can only be used as a first approximation for the actual crop coverage.

15.6 Table 15.3 is a summary of available production data from the farming systems survey and the PBME exercise.

Table: 15.3
SMALLHOLDER PRODUCTION SUMMARY

commodity	area (ha)	growing period (months)	annual production (kg)
sweet potato	0.107	4.2	974
cassava	0.009	7.5	357
yam	0.051	7.6	612
pana	0.212		1,677
taro			117
breadfruit			
banana			204
Source table:	9.2	11.3	15.2

Chapter: 16
LABOUR

16.1 With little or no cash inputs applied in the farming systems under study, the main component in the socio-economy of smallholder agriculture is labour. Table 16.1 presents an overview of labour constraints expressed by farmers. The first part of the table shows the frequency of gardens affected and is expressed in terms of area affected in the second part.

Table: 16.1
LABOUR CONSTRAINTS

i) Labour Constraints by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no limitation	1	12		85	98
lack of labour		7		15	22
lack of inputs/cash		5		1	6
lack of labour + cash		10		4	14
garden too far from house				11	11
garden too far + labour		1		2	3
garden too far + cash					
too far + labour + cash		2			2
total by crop type		37		118	156

ii) Labour Constraints by % area of holding

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no limitation		13		21	33
lack of labour		35		4	39
lack of inputs/cash		-			-
lack of labour + cash		10		1	11
garden too far from house				3	3
garden too far + labour		3		1	4
garden too far + cash					
too far + labour + cash		3			3
total by crop type		69		31	100

Note: The table of % area is only approximate due to rounding small numbers

16.2 Diagram 16.1 summarises labour constraints by area, and refers to the "average" holding of 1.312ha defined in table 9.2, in which 69% is tree crops and 31% is food crops.

16.3 As has been seen in an analysis of labour density in chapter 8, coconut management in chapter 10, and factors affecting production in chapter 13, the dominant constraint is found to be labour on tree crops. A labour shortage is recorded on **74%** of the tree crop area, while a shortage of inputs or cash is recorded on **29%** of the area. In contrast only **19%** of the food crop area is affected by a shortage of labour and only **3%** from a shortage of inputs or cash.

16.4 **8%** of tree crop gardens representing **9%** of the tree crop area, and **11%** of food crop gardens representing **13%** of the food crop area, are said to be too far from the household. Distance to gardens is becoming a problem although most gardens remain close to households. In Chapter 12 it was shown that the mean distance from households is **0.264** hours, up to a maximum distance of **1.3** hours.

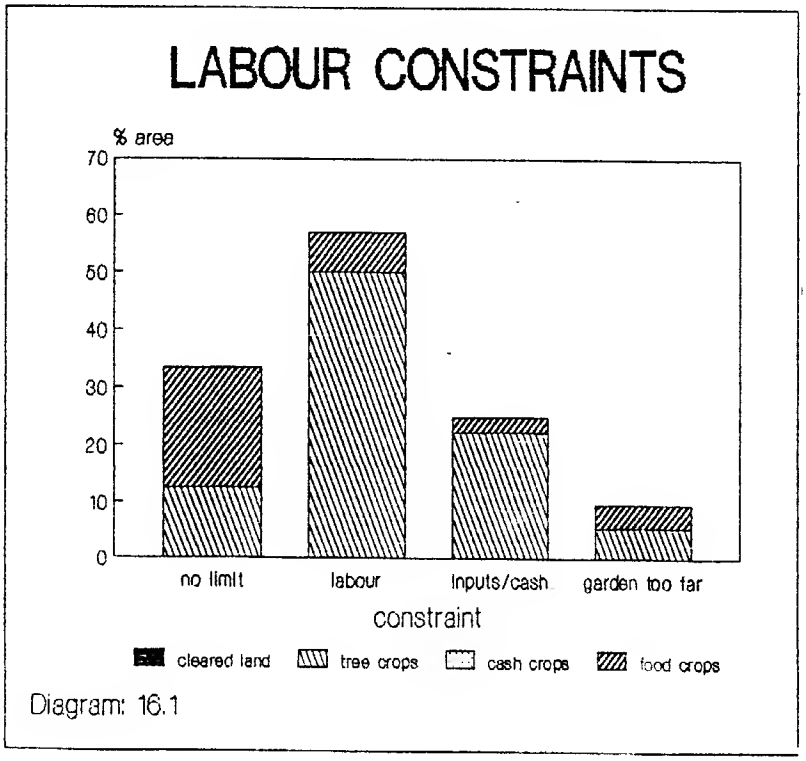


Diagram: 16.1

16.5 Table 16.2 summarises the labour requirements of the average holding, derived from individual plot labour studies presented in annex 2. The table is a "model" budget representing the average of complex and diverse holdings. Individual crop budgets in annex 2 may be used to construct farm budgets for hypothetical holdings, but caution should be exercised where there are few observations. Labour days in budgets presented here are based on actual hours worked per day, which are quite variable. Again, tables in annex 2 may be used to convert work hours into "standard" work days if required. Since table 16.2 represents the average holding, crops which comprise only minor mixtures in cropping patterns do not appear in the summary labour budget.

16.6 The table shows the labour requirement of each agricultural operation according to crop, which may be a pure stand or more commonly the dominant crop in a mixture. Agricultural operations cover: land clearance; cultivation; planting; first, second and third weeding; and harvesting. For some crops - notably, but not exclusively, trees - there may be additional operations such as pruning or thinning which do not easily fall within the standard classification. Two general categories of establishment and maintenance operations are therefore included. Such a classification provides good coverage for most activities and allows diverse crops to be handled in a standard manner.

16.7 In the interpretation of labour budgets it should be remembered from chapter 9 that while coconuts account for **64%** of the cropped area they are grown by only **36%** of farmers. Thus the majority of tree cropping farmers will require more labour on tree crops than specified, while non-tree cropping farmers will not require any. Labour budgets are also presented on the basis of labour input "when operations are performed". Adjustment is not made to the labour input to take account of operations which are omitted, forinstance where a proportion of plots are not weeded a second or third time. The number of observations on which labour operations are based in annex 2 provides a guide to the relative frequency that operations are performed, and so adjustments can be made to budgets based on different assumptions about management intensity. Incorporating this into the present analysis would considerably increase the complexity of presentation while introducing ambiguity into the results.

16.8 Coconuts account for 46% of the labour expended in land clearance, requiring 59 work days per year. Root crops account for a further 48% of labour expended. Pana and sweet potato, the dominant root crops, require 53 work days per year. On a unit area basis the labour requirement of root crops is more than twice that of coconut. Sweet potato accounts for 214 work days per hectare compared with around 150 workdays per hectare from other root crops and 72 work days per hectare for coconuts. Men contribute on average twice as much labour on land clearance as women. Of 128 work days, men contribute 62% compared to to 30% from women. 9% of labour on land clearance for coconuts and cocoa is hired. Men and women contribute about the same proportion of labour across the range of crops and no crop is the exclusive preserve of either men or of women.

16.9 Coconuts dominate the labour budget on cultivation, requiring 72 work days compared with 35 days for root crops. On a per hectare basis the requirements of tree crops and root crops are similar, at around 90 work days per hectare. Of 109 work days per year men contribute 95% and women 4%. 1% of labour on cultivation is hired. Men contribute most labour on cultivation over the entire range of crops, including tree and root crops.

16.10 39% of the labour expended in planting is on coconuts, accounting for 29 work days per year. Root crops account for 58% of labour expended on planting, requiring 36 work days. On a per hectare basis the planting of root crops requires about three times as much labour as tree crops. Of 62 work days per year required on planting throughout the holding, men contribute 40% and women contribute 58%. 2% of labour is hired for the planting of coconuts. Men perform the planting of coconuts while women are responsible for the planting of food crops.

16.11 27 days per year are worked on the establishment and tending of coconuts and cocoa on which men provide 93% of the labour. Women provide 4% on cocoa plantings, and hired labour provides a further 4%.

16.12 22 work days are spent per year on the maintenance of coconut and cocoa plantings. Men again provide 95% of this compared, with 5% hired.

16.13 58 work days are spent on the first weeding of crops, of which 18 days are accounted for by coconuts and 37 days by root crops. Labour is predominantly supplied by women, who contribute 67% of the labour on first weeding compared with 31% from men and 2% from hired labour. On coconuts men provide 78% of the labour for first weeding (brushing), women account for 17%, and 6% is

from hired labour. Men provide most of the labour required for the brushing of coconuts while women provide most of the labour on the weeding of all other crops, particularly on root crops.

Table: 16.2
ANNUAL LABOUR INPUT BY HOLDING

	⟨------ work days per year -----⟩					⟨- % contribution -⟩			labour
	⟨----- per holding -----⟩				per ha				cost
	men	women	paid	total	average	men	women	paid	(I)
i) Land Clearance									
Cleared land	1			1	75	100			
Coconut	36	14	9	59	72	61	24	15	6
Cocoa	4		2	6	104	67		33	1
Pineapple									
Sweet Potato	15	8		23	214	65	35		1
Yam	3	4		7	147	43	57		
Pana	19	11		30	146	63	37		1
Cassava	1	1		2	169	50	50		
Total holding	79	38	11	128		62	30	9	9
ii) Cultivation									
Cleared land									
Coconut	71		1	72	86	99		1	1
Cocoa	1	1		2	29	50	50		
Pineapple									
Sweet Potato	8	1		9	88	89	11		
Yam	4			4	90	100			
Pana	20	2		22	105	91	9		
Cassava					47				
Total holding	104	4	1	109		95	4	1	1
iii) Planting									
Cleared land									
Coconut	23		1	24	29	96		4	1
Cocoa	1	1		2	27	50	50		
Pineapple									
Sweet Potato	1	9		10	97	10	90		
Yam		3		3	66		100		
Pana		23		23	113		100		
Cassava					45				
Total holding	25	36	1	62		40	58	2	1

ANNUAL LABOUR INPUT BY HOLDING (continued)

	(------ work days per year -----) (----- per holding -----)				per ha	(- % contribution -)			labour cost
	men	women	paid	total	average	men	women	paid	(I)
iv) Crop Establishment									
Cleared land									
Coconut	23		1	24	29	96		4	1
Cocoa	2	1		3	42	67	33		
Pineapple									
Sweet Potato									
Yam									
Pana									
Cassava									
Total holding	25	1	1	27		93	4	4	1
v) Crop Maintenance									
Cleared land									
Coconut	19		1	20	24	95		5	1
Cocoa	2			2	38	100			
Pineapple					6				
Sweet Potato									
Yam									
Pana									
Cassava									
Total holding	21		1	22		95		5	1
vi) First Weeding									
Cleared land									
Coconut	14	3	1	18	21	78	17	6	2
Cocoa	1	2		3	47	33	67		
Pineapple									
Sweet Potato	1	9		10	95	10	90		
Yam		3		3	74		100		
Pana	2	22		24	114	8	92		
Cassava					21				
Total holding	18	39	1	58		31	67	2	2

ANNUAL LABOUR INPUT BY HOLDING (continued)

	(------ work days per year -----) (----- per holding -----)				per ha	(- % contribution -)			Labour cost
	men	women	paid	total	average	men	women	paid	(I)
viii) Second Weeding									
Cleared land									
Coconut	12	1	1	14	17	86	7	7	2
Cocoa	1			1	11	100			
Pineapple									
Sweet Potato	1	6		7	64	14	86		
Yam		3		3	60		100		
Pana	2	13		15	71	13	87		
Cassava					16				
Total holding	16	23	1	40		40	58	3	2
viii) Third Weeding									
Cleared land									
Coconut	10	2		12	14	83	17		
Cocoa	1			1	11	100			
Pineapple									
Sweet Potato	1	4		5	44	20	80		
Yam		3		3	49		100		
Pana	6	25		31	147	19	81		
Cassava					16				
Total holding	18	34		52		35	65		
ix) Harvesting									
Cleared land									
Coconut	16	16		32	38	50	50		
Cocoa	1	1		2	23	50	50		
Pineapple					9				
Sweet Potato	1	32		33	304	3	97		
Yam		4		4	75		100		
Pana	1	54		55	257	2	98		
Cassava					47				
Total holding	19	107		126		15	85		

16.14 40 work days are spent on the second weeding of crops, of which 14 days are on coconuts and 25 days are on root crops. On a per hectare basis the labour input on root crops around 70 days per hectare on second weeding compared with 17 days per hectare on coconuts. Women provide 58% of labour on second weeding, compared with 40% from men and 3% hired labour. Women perform almost all the weeding of root crops while men are largely responsible for tree crops.

16.15 52 work days are spent on third weeding, of which men contribute 35% and women 65%. Women again provide most of the labour for the weeding of root crops, but only 17% of the labour on coconuts.

16.16 126 work days are spent on harvesting, mostly by women. Men account for 15% of labour in harvesting compared with 85% from women. Women provide most of the labour on harvesting root crops and provide 50% of the labour on tree crops. Women therefore provide 107 harvesting labour days to 19 days from men.

16.17 Overall women provide 45% of labour compared with 52% from men. The composition of households presented in table 3.3 shows a balance of males and females but a greater labour availability among females due to differences in age structure. Men are predominantly concerned with the expansion of cropping and the establishment of new enterprises, particularly on the cash crops of coconuts and cocoa where they provide most labour on land clearance, cultivation, establishment and maintenance. In contrast women provide most labour on food gardens, especially in weeding and harvesting.

16.18 Labour is a constraint on coconuts where 74% of the tree crop area has a labour shortage. This is seen in the standard of mamagement in chapter 10 in which 65% of coconut plantings have reverted to secondary bush. Hired labour is necessary to make up the labour shortfall on coconuts and overall accounts for 17% of the total labour expenditure. In contrast, labour is not a major limitation on annual crops.

16.19 A labour summary presented first by crop and then by operation is provided in table 16.3. Overall there are 624 work days per year required on an "average" holding of which 325 are provided by men, 282 by women and 17 by paid labour at an annual cost of SI$17. The average adult man in the household spends 208 days working on the holding and the average adult woman spends 163 days, with an additional 17 days of hired labour. Communal labour, which is assumed to be reciprocated and so balances out, is included in family labour.

16.20 Men apparently contribute more farm labour than women and work 27% more per unit labour.

Table: 16.3
SUMMARY OF LABOUR INPUT

	⟨------ work days per year -----⟩ ⟨----- per holding -----⟩				per ha	⟨- % contribution -⟩			labour cost
i) By Crop	men	women	paid	total	average	men	women	paid	(SI$)
Cleared Land	1			1					
Coconut	324	36	15	275	330	81	13	5	14
Cocoa	14	6	2	22	332	64	27	9	1
Pineapple					15				
Sweet Potato	28	69		97	906	29	71		1
Yam	7	20		27	561	26	74		
Pana	50	150		200	953	25	75		1
Cassava	1	1		2	361	50	50		
All Crops	325	282	17	624		52	45	3	17
ii) By Operation									
Land Clearance	79	38	11	128		62	30	9	9
Cultivation	104	4	1	109		95	4	1	1
Planting	25	36	1	62		40	58	2	1
Tree Crops Establishment	25	1	1	27		93	4	4	1
Tree Crops Maintenance	21		1	22		95		5	1
First Weeding	18	39	1	58		31	67	2	2
Second Weeding	16	23	1	40		40	58	3	2
Third Weeding	18	34		52		35	65		
Harvesting	19	107		126		15	85		
All Operations	325	282	17	624		52	45	3	17
Available labour units	:1.56	1.73							
Days per unit labour	: 208	163	17						

16.21 Labour by crop is illustrated in diagram 16.2. Coconuts account for **44%** of the holding labour budget with a requirement of 275 work days per year. Root crops require a further 326 work days per year. Men provide **81%** of the labour on coconuts and around **27%** of the labour on root crops, while women provide **13%** of the total labour on coconuts and about **75%** of the labour on root crops. Overall men contribute **52%** of labour, women provide **45%**, and **3%** is accounted for by hired labour.

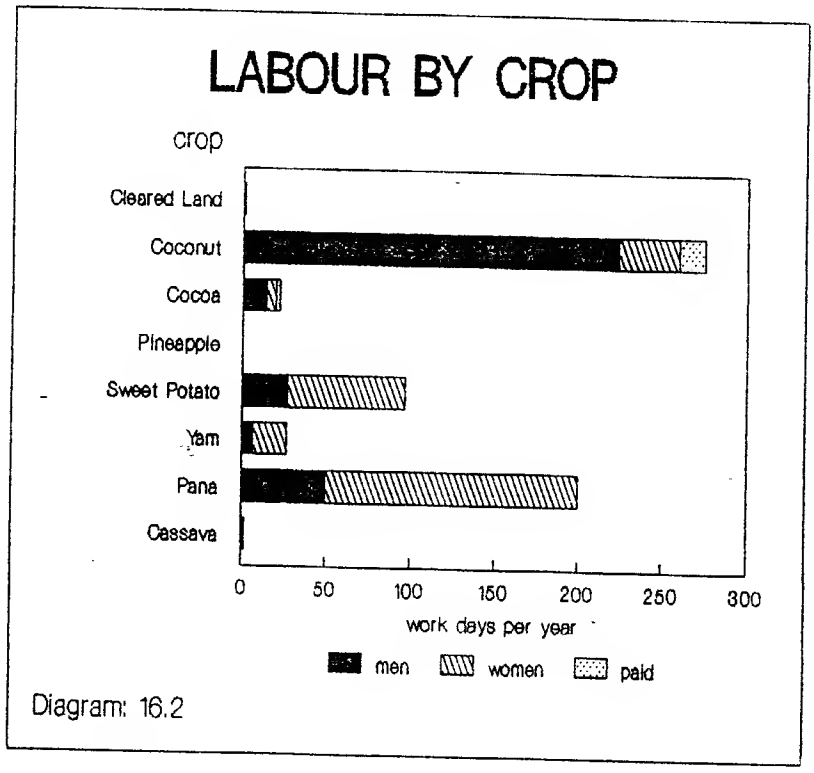


Diagram: 16.2

16.22 Labour by operation is illustrated in diagram 16.3. Men provide most labour on clearance, cultivation and tree crops maintenance while women provide most labour on planting, weeding and harvesting.

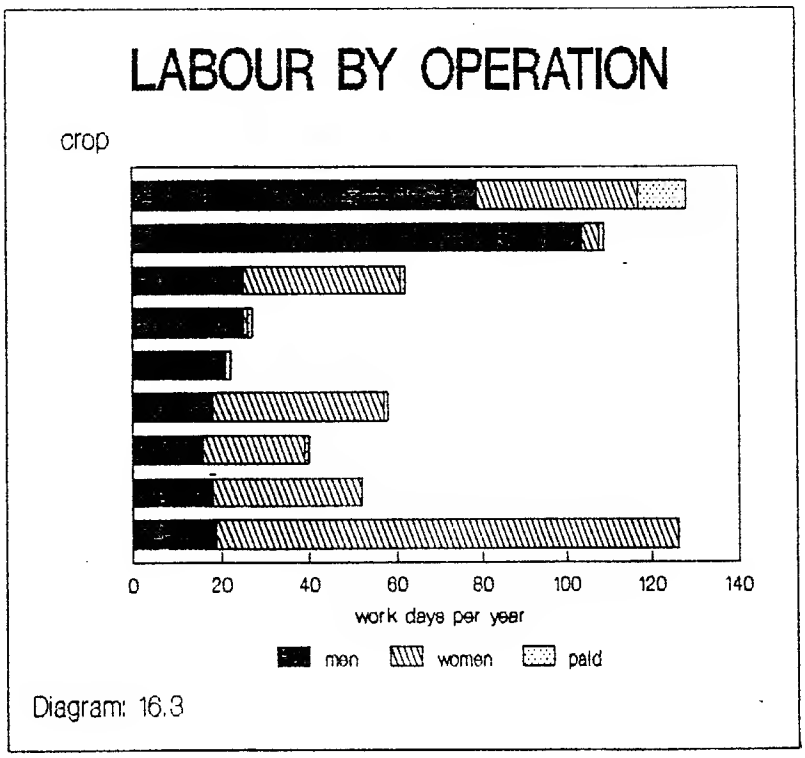


Diagram: 16.3

16.23 Flemming[29] states that Solomon Islands manpower planning figures "have erroneously assumed a far higher participation rate of men than women in the rural labour force ... It is important that attempts to clarify the rural labour force do not further these misunderstandings".

16.24 Diagram 16.4 illustrates the contribution from men, women and hired workers in the annual labour budget. Women provide **87%** of the level of agricultural labour provided by men , and contribute **78%** of the level of men per labour unit. The average woman works **163** days on agricultural work compared with **208** days for the average man. Differences may emerge if labour budgets are re-computed on the basis of work hours, since the average number of hours worked per day varies by operation and by crop. It is possible to re-construct budgets based on work hours rather than work days, or to standardise work days, from the tables in annex 2. It is clear, however, that women provide a substantial proportion of agricultural labour.

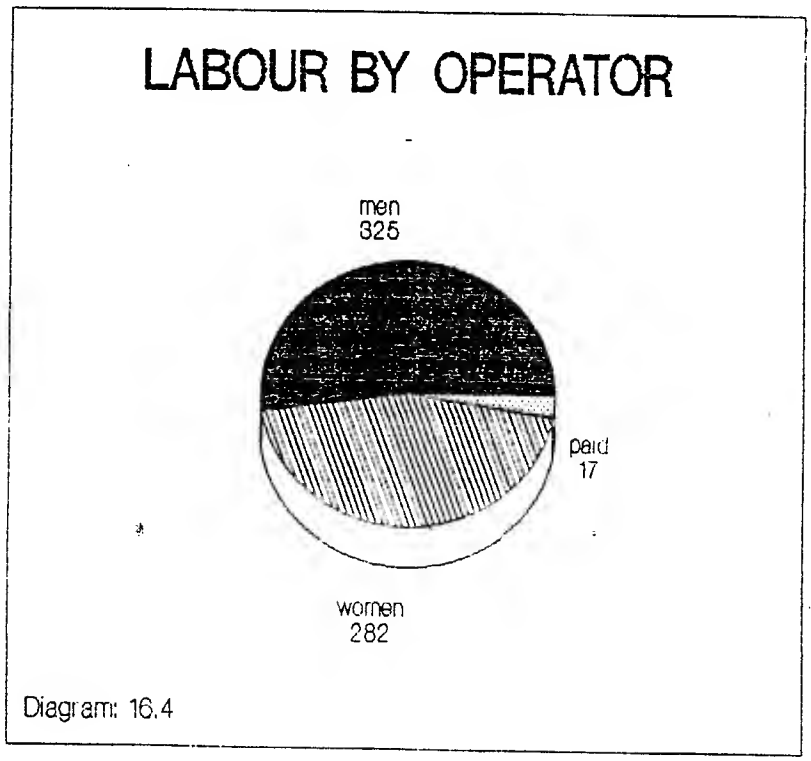


Diagram: 16.4

Chapter: 17
CROP AND FARM BUDGETS

17.1 It is not possible to produce comprehensive crop and farm budgets because of the complexity and diversity of cropping patterns, and production data are as yet incomplete. The main elements are, however, available. A summary of information on cropping patterns, production and labour is presented in Table 17.1 where source references to tables in the text shown at the foot of the table. It is not possible at this stage to directly relate production to other factors.

Table: 17.1
ELEMENTS OF A FARM BUDGET

main crop in mixture	area (ha)	annual production (kg)	annual labour	
			work days	cost (I)
a Cleared Land	0.014		1	
b Coconut (husked whole nuts)	0.835	621	275	14
c Cocoa	0.061		22	1
d Pasture				
e Grain Crops				
f Beans				
g Cabbage		94		
h Vegetables		43		
i Spices				
j Fruit Crops	0.019	112		
k Fruit trees				
l Banana		204		
m Citrus trees				
n Nut trees	0.004			
o Sugar cane				
p Food/building tree				
q Tobacco				
r Sweet Potato	0.107	974	97	1
s Taro		117		
t Yam	0.051	612	27	
u Pana	0.212	1,677	200	1
v Cassava	0.009	357	2	
w Other root crop				
Total	1.312		624	17
Table reference	9.2	15.2	16.3	16.3

Chapter: 18
CASH CROP PROCESSING

18.1 Table 18.1 presents a labour budget for the production of copra, based on 10 observations which is the **20%** of sampled farmers earning income from copra (from table 4.2). It is lower than the proportion of farmers growing coconuts, which is **35%** of farming households. Copra is only produced by **50%** of coconut growing farmers although from table 10.2 it is known that only **10%** of stands are less than 8 years old and, while **14%** are older than 40 years, **90%** of plantings should be in bearing condition. It is also known, however, that **65%** of coconut plots are poorly maintained and that labour is a constraint.

18.2 The labour input in the production of copra is **93%** family and 7% hired, at an annual cash cost of **SI$4.2**. Hired labour is employed for husking, while all operations are performed by family labour.

18.3 Copra manufacture is labour intensive, requiring 217 work days per annum to produce **1,789kg** copra, or one work day per **8kg** copra produced. **126** work days are spent on harvesting and shelling the nuts which account for **59%** of the total production time. Firewood collection takes 21 days or **9%** of the time; and drying, bagging and transport take 53 days or **22%** of the time. The annual labour input is illustrated in diagram 18.1.

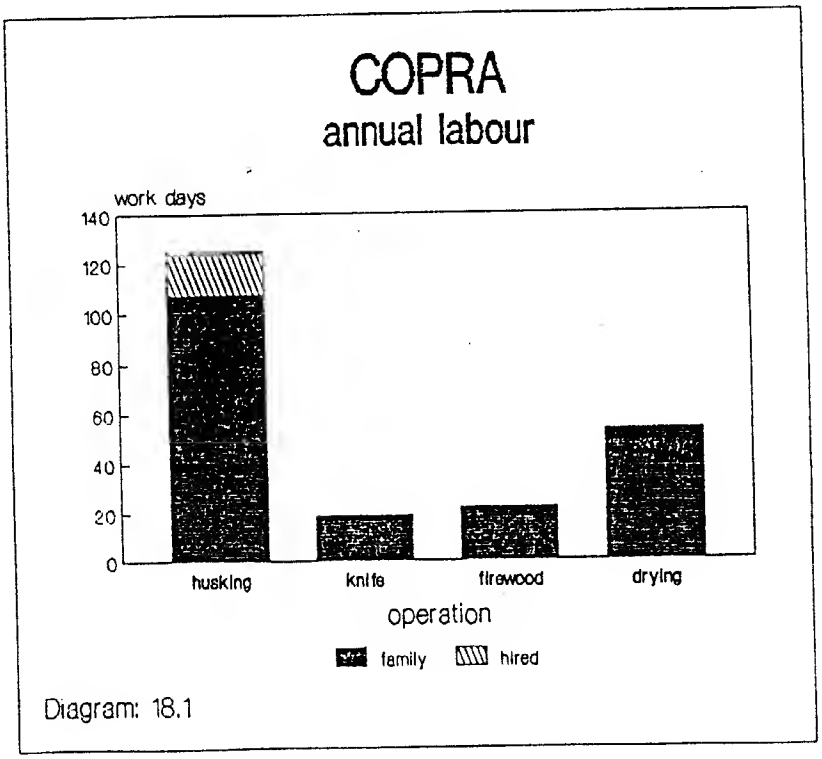


Diagram: 18.1

Table: 18.1
ANNUAL COPRA PRODUCTION AND LABOUR EXPENDITURE

Annual Labour Expenditure		family or shared labour		hired labour		total	% labour by operation
		work hours	work days	work days	cash cost ($.c)	work days	
HUSKING	picking, heaping	173.4	24.5			24.5	10
	husking	177.6	24.8	16.9	4.22	41.7	17
	transport	127.5	19.7			19.7	8
	breaking	109.4	19.0			19.0	8
	shelling	134.3	19.7			19.7	8
	total	722.1	107.6	16.9	4.2	124.5	51
COPRA KNIFE	picking, heaping	30.7	6.3			6.3	3
	axing + copra knife	53.3	8.7			8.7	4
	transport	13.3	3.3			3.3	1
	total	97.3	18.3			18.3	8
FIREWOOD	collection	28.0	3.9			3.9	2
	transport	15.1	1.9			1.9	1
	collection + transport	101.6	15.6			15.6	6
	total	144.7	21.4			21.4	9
DRYING	drying	222.0	38.8			38.8	16
	bagging	27.9	8.0			8.0	3
	transport	111.4	6.3			6.3	3
	total	361.3	53.2			53.2	22
TOTAL		1325.4	200.5	16.9	4.2	217.4	100
% labour by type of labour			92	8		100	

copra grade	quantity of copra produced (kg)	
	per annum	per work day
Grade 1	1,789	8
Grade 2		
Grade 3		
Ungraded		
total	1,789	8

Number of observations = 10

18.4 The gross margin for copra production is summarised in table 18.2. From an annual production of **1,789kg** valued at the prevailing price of 33 cents per kilo the gross return is **SI$590**. Inputs costs from bags and twine amount to **SI$26.52** and labour costs are **SI$4.20**. The net income is **SI$559** which, at a requirement of 201 household labour days, represents a net return to labour of **SI$2.78** per household work day.

Table: 18.2
COPRA GROSS MARGIN

Annual production (kg)	1,789
Price per kilogram (SI)	0.33
Gross return (SI)	590
Inputs cost (SI)	26.52
Labour cost (SI)	4.20
Net return (SI)	559
Household labour days	201
Copra production per household work day (kg)	8.90
Net return per household work day (SI)	2.78

Inputs costs: Sacks @ SI$1.00 per new sack;
Average packed weight 70kg = 26 sacks = SI$26.00.
Twine @ SI$1.00 per hank of 50 strings = SI$0.52.

18.5 Table 18.3 presents the budget for cocoa processing, undertaken by two sampled farmers.

Table: 18.3
ANNUAL COCOA PRODUCTION AND LABOUR EXPENDITURE

Annual Labour Expenditure		family or shared labour		hired labour		total	% labour by operation
		work hours	work days	work days	cash cost ($.c)	work days	
FIELD	harvesting	505.8	180.0			180.0	37
	breaking pod	128.4	54.0			54.0	11
	transport	42.0	54.0			54.0	11
	total	676.2	288.0			288.0	60
FIREWOOD	collection						
	transport						
	collection + transport						
	total						
DRYING	fermenting	145.2	26.0			26.0	5
	drying	162.0	138.0			138.0	
	bagging	24.2	16.0			16.0	3
	transport	32.0	16.0			16.0	3
	total	363.4	196.0			196.0	40
TOTAL		1039.6	484.0			484.0	100
% labour by type of labour			100			100	

cocoa	quantity of cocoa produced (kg)	
	per annum	per work day
Wet beans Dry Beans	50	0.1
total	50	0.1

Number of observations = 2

18.6 In total 484 work days were expended in the production of only **50kg** dry beans. All labour was from the household so there is no direct cash cost. Very high amounts of labour on harvesting, breaking and field transport accounts for **60%** of the total labour expenditure, while **40%** is expended in drying, bagging and transporting to market. Labour expenditure in the production of cocoa is illustrated in diagram 18.2.

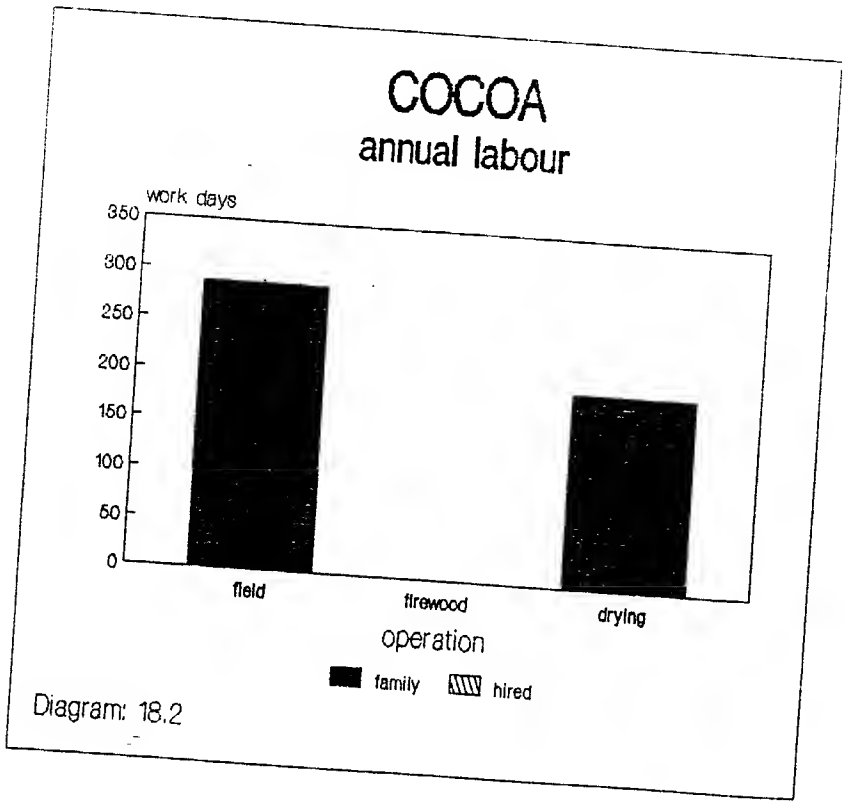


Diagram: 18.2

18.7 The gross margin for cocoa is shown in table 18.4, however, labour input in terms of days worked appears undully high because few hours are spent working per day. An annual production of 50kg of cocoa at the prevailing price of SI$1.80 per kilo provides a gross return of SI$90. Inputs costs amount to SI$1.02. There is no hired labour and so the net return is I$89, representing a return to labour in this case of only SI$0.18 per family day worked.

Table: 18.4
COCOA GROSS MARGIN

Annual production (kg)	50
Price per kilogram (I)	1.80
Gross return (I)	90
Inputs cost (I)	1.02
Labour cost (I)	0
Net return (I)	89
Household labour days	484
Cocoa production per household work day (kg)	0.1
Net return per household work day (I)	0.18

Inputs costs: Sacks @ SI$1.00 per new sack;
Average packed weight 65kg = 1 sacks = SI$1.00;
Twine @ SI$1.00 per hank of 50 strings = SI$0.02.

Chapter: 19
MARKETING

19.1 Table 19.1 presents a summary of marketing data collected in the survey, listing crops marketed against the number of observation recorded. The mean weight marketed is recorded, the time taken to go to market and back, the number of times the commodity is marketed per year, and the number of people involved in marketing. These are grouped under the heading of "marketing" details.

19.2 Marketing costs are recorded under the headings of freight or transport costs, fares for people involved in marketing, and market tax which may be imposed at the point of sale.

19.3 Revenues are possible where wages are earned, for instance from selling other farmers' produce and from the sale of crops. It is often difficult for sellers to specify costs and revenues, and in such cases data have to be treated as "missing". Thus the number of observations for crop sales may be lower than those for marketing data.

19.4 Table 19.2 is a transformation of the raw marketing data into an "average" annual marketing budget. The data are incomplete because of difficulties in recalling weights sold and marketing revenues. It is presented not as a model marketing budget, but as a data set to provide as much information on marketing as possible, albeit with gaps.

19.5 The two right-most columns show the net marketing revenue by crop and by household. The "net marketing revenue by crop" is the net return from sales after deducting costs. It is not the average income from crop sales since revenue may be negative where income data are missing or as a result of the double counting of transport costs when freight expenses are shared among several crops.

19.6 The "net marketing revenue per household" is the average household earnings taking account of the proportion of households selling each type of crop, but based on the limitations of the crop revenue data.

Table: 19.1
MARKETING TIME AND CROP PRICES

Basic Marketing Data:

		(---------- marketing ----------)					(--------- costs --------)			(-- revenues --)		
		number of obs	mean weight marketed	time to market and back	times marketed per year	number of people	freight/ transport cost	fares for people	market tax	wages earned	crop sale price	crop sale obs
		(obs)	(kg)	(days)	(times)	(people)	(SI$)	(SI$)	(SI$)	(SI$)	($/kg)	(obs)
ALL CROPS	Average	78	186	2.3	7	1	5.17	6.52	0.41	0.36	0.51	38
COCONUT	Coconut	12	367	3.7	8	1	12.75	10.58	0.15	0.42	0.43	7
	Copra	3	467	4.3	2	1	7.67	14.67			0.21	3
COCOA	Dry Beans	1	8	7.0	1	1		12.00			2.20	1
ROOT CROPS	Sweet Potato	18	129	1.4	6	2	4.94	6.75	0.92	0.64	0.36	8
	Taro Common	1	125	1.0	3	1					0.20	1
	Yam	1	40	7.0	3	1	20.00	16.00	1.00		0.40	1
	Pana	9	79	3.2	8	2	4.56	6.33	0.37	0.61	0.38	4
	Cassava	3	120	1.0	6	1	2.00	2.00	0.33		0.25	2
BEANS	Beans	2		0.5	9	2	6.00		0.25		0.40	1
CABBAGE	Cabbage	3	10	1.0	7	1	0.33	1.33	0.33		1.80	1
	Hibiscus cabbage	1		1.0	2	1	12.00					
VEGETABLE	Tomato	2		0.5	9	2	6.00		0.25		0.33	1
FRUIT CROPS	Pineapple	2		3.8	13	1		8.00	0.50			
BANANA	Banana	4		3.5	3	1	3.00	9.00	0.50	0.20	0.50	2
	Sweet banana	5		0.6	5	2	2.40	1.60	0.10			
NUT TREES	Ngali Nut	1		1.0	52	3	5.00	15.00	0.50	5.00		
	Cut Nut	1		1.0	2	1	2.00	2.00				
	Betel Nut	9	41	2.2	5	1	0.39	4.89	0.22		0.74	6
Number of households		56										

Table: 19.2
INCOME FROM MARKETING

Annual Marketing Budget:

		% houses marketing crop (%)	weight marketed (kg)	work days (days)	costs (SI$): freight/ transport cost (SI$)	fares for people (SI$)	market tax (SI$)	total marketing costs (SI$)	revenues (SI$): wages earned (SI$)	crop sales (SI$)	total revenue (SI$)	net marketing revenue by crop (SI$)	net marketing revenue per household (SI$)
ALL CROPS	Average		1225	21.9	34	43	3	79.71	2	621.16	623.51	544	315
COCONUT	Coconut	21	2784	34.8	97	80	1	178.05	3	1203.63	1206.79	1029	220
	Copra	5	1089	10.1	18	34		52.11		225.51	225.51	173	9
COCOA	Dry Beans	2	8	7.0		12		12.00		17.60	17.60	6	0
ROOT CROPS	Sweet Potato	32	747	14.8	29	39	5	72.86	4	267.51	271.21	198	64
	Taro Common	2	375	3.0						75.00	75.00	75	1
	Yam	2	120	21.0	60	48	3	111.00		48.00	48.00	-63	-1
	Pana	16	620	45.2	36	50	3	88.79	5	232.53	237.35	149	24
	Cassava	5	720	8.0	12	12	2	26.00		176.98	176.98	151	
BEANS	Beans	4		6.4	51		2	53.13				-53	
CABBAGE	Cabbage	5	73	9.8	2	10	2	14.67		132.00	132.00	117	
	Hibiscus cabbage	2		2.0	24			24.00				-24	0
VEGETABLE	Tomato	4		6.4	51		2	53.13				-53	-2
FRUIT CROPS	Pineapple	4		48.8		104	7	110.50				-111	
BANANA	Banana	7		8.8	8	23	1	31.25	1		0.50	-31	
	Sweet banana	9		5.4	12	8	1	20.50				-21	
NUT TREES	Ngali Nut	2		156.0	260	780	26	1066.00	260		260.00	-806	
	Cut Nut	2		2.0	4	4		8.00				-8	
	Betel Nut	16	195	10.4	2	23	1	26.28		144.15	144.15	118	

19.7 Table 19.3 shows the time taken to different markets and the type of crop sold at each market. The classification of markets is subject to local interpretation, where "central" would generally be the provincial capital.

Table: 19.3
MARKET LOCATION

market location:		local	inter-mediate	central	Honiara	% obs	number of obs
i) Time taken to market produce							
time taken to go to market and back (days)		(% observations)					
0 - .5		1	9	1		12	9
.5 - 1		4	19	36		59	46
1 - 2				3		3	2
2 - 5				1	6	8	6
5 - 10					19	19	15
) 10							
% observations		5	28	41	26	100	
number of observations		4	22	32	20		78
mean time (days)		0.75	0.80	1.11	6.30		1.75
ii) Crops sold at different markets		(% observations)					
COCONUT	coconut		3	5	8	15	12
	copra				4	4	3
COCOA	dry beans				1	1	1
ROOT CROPS	sweet potato	3	5	14	1	23	18
	taro common		1			1	1
	yam				1	1	1
	pana	1	1	5	4	12	9
	cassava		1	3		4	3
BEANS	beans		1	1		3	2
CABBAGE	cabbage		1	3		4	3
	hibiscus cabbage		1			1	1
VEGETABLE	tomato		1	1		3	2
FRUIT CROPS	pineapple		1		1	3	2
	banana			3	3	5	4
	sweet banana	1	4	1		6	5
NUT TREES	ngali nut			1		1	1
	cut nut		1			1	1
	betel nut		5	4	3	12	9
		5	28	41	26	100	
		4	22	32	20		78

19.8 Table 19.4 summarises crop price perception and sale volumes.

Table: 19.4
CROP PRICE PERCEPTION AND SALE VOLUMES

		⟨---- sale price ----⟩ poor	average	good	⟨----- sale volume -----⟩ little	average	more than usual	number of obs
COCONUT	Coconut	8	83	8	33	67		12
	Copra	67		33	33	67		3
COCOA	Dry Beans		100		100			1
ROOT CROPS	Sweet Potato	11	33	56	28	72		18
	Taro Common			100	100			1
	Yam			100		100		1
	Pana	11	33	56		100		9
	Cassava		33	67		100		3
BEANS	Beans	100			50	50		2
CABBAGE	Cabbage		33	67		100		3
	Hibiscus Cabbage	100				100		1
VEGETABLE	Tomato	50		50	50	50		2
FRUIT CROPS	Pineapple		100				100	2
	Banana	25	25	50	75	25		4
	Sweet Banana	20	80		40	60		5
NUT TREES	Ngali Nut			100		100		1
	Cut Nut		100			100		1
	Betel Nut	56	44		22	78		9
Number of observations		17	34	27	21	55	2	78

19.9 There is little association between crop prices and sales due to depressed sales and inflated prices as a result of the drought. Many producers sell about "average" amounts irrespective of whether the price is felt to be good or not.

19.10 Table 19.5 summarises marketing problems. To the right of the table are the proportion of cases by severity of problem. These are combined with crop type in the body of the table to show the "index of severity". In this index "no problem" is weighted "0", "slight problem" is weighted "0.5", and "severe problem" is weighted "1.0". Thus if all cases registered a severe problem the index would be "1.0".

Table: 19.5
MARKETING PROBLEMS

Number of observations = 78

	⟨--- crop type ---⟩			⟨--- severity of problem ---⟩		
	coconut and cocoa	root crops	other crops	none	slight	severe
	(index of severity)			(% cases)		
terrain too difficult	0.0	0.0	0.2	76	6	18
distance too great	0.1	0.1	0.2	38	35	27
not enough time/labour	0.1	0.1	0.1	63	32	5
transport cost too high	0.1	0.1	0.1	56	18	26
low price at market	0.1	0.1	0.1	58	28	14
lack of transport	0.1	0.1	0.1	67	19	14
unreliable transport	0.0	0.0	0.1	74	15	10
risk of not selling enough	0.0	0.1	0.1	68	23	9
crop damage in transit	0.0	0.0	0.0	90	8	3
administrative restrictions	0.0		0.0	94	4	3
quarantine control				100		
other problem				100		

Note: "Index of Severity is a weighted summary of severity of marketing problems.
It falls in the range 0 to 1 where 0.0 = no marketing problem
0.5 = slight marketing problem
1.0 = severe marketing problem

19.11 Numerous problems are experienced, although few appear severe. About 20-30% of marketing problems are regarded as slight and around 10-20% are severe.

Annex: 1
CROP NAMES AND CODES

A1.1 The following list describes the hierarchical coding sequence used by AES in farming systems surveys to describe crop types. The list may be added to by inserting other crops of interest within the appropriate category.

A1.2 At the garden level only broad distinctions are made between cleared land, tree crops, short term cash crops, and food crops. Only single digit numeric codes are permitted at this level and these do not distinguish between crop type or mixtures. They do, however, provide important information about the structure of the holding. Code "1" for instance specifies "tree crops".

A1.3 At the plot level alphabetical codes are used to describe crop mixtures. These are used to describe cropping patterns and the analysis of labour by crop. Letter codes are strung together so there is no pre-set limit on the complexity of mixtures described. Some simplification is introduced within the code categories themselves. The dominant crop is listed first and other crops are listed to the right in decreasing order of importance. The string code then takes the form of an alphabetical "number", where the most significant characters are to the left and the least significant to the right. Forinstance "a" specifies "cleared land", while "rvgfl" specifies a mixture in decreasing order of importance of "sweet potato, cassava, cabbage, beans, banana".

A1.4 At the yield and marketing levels it is necessary to specify exactly the crop under study, and so a unique three-digit numeric code is assigned to each crop. The list need not be complete and may be added to as necessary since "spare codes" are available. Forinstance "613" specifies "pineapple".

Table: A1.1
CROP NAMES AND CODES

garden code	garden name	plot code	yield and marketing code	yield and marketing name	scientific name
0	cleared	a	100	CLEARED (unplanted)	
1	tree crops	b	200	COCONUT	Cocos nucifera
			210	Local Tall	
			211	Rennel	
			212	Dwarf Hybrid	
			219	Other	
			250	Copra	
1	tree crops	c	300	COCOA	Theobroma cacao
			310	Cocoa green beans	
			311	Cocoa dry beans	
		d		Pasture	
3	food crops		400	ROOT CROPS	
		r	410	Sweet Potato	Ipomoea batatas
		s	411	Taro Common	Colocasia esculenta
		s	412	Giant	Alocasia micorhiza
		s	413	Hong Kong	Xanthosoma saggitifolium
		s	414	Swamp	Cytosperma chamissonis
		t	415	Yam	Dioscorea alata
		u	416	Pana	Dioscorea esculenta
		v	417	Cassava	Manihot esculenta
		w	419	Other root crop	
3	food crops	e	430	GRAIN CROPS	
			431	Corn	Zea mays
			432	Peanuts	Arachis hypogaea
			439	Other grain crop	
3	food crops	f	440	BEANS	
			441	Long bean	Phaseolus vulgaris
			442	Wing bean	Psophocarpus tetragonolobus
			443	Snake bean	Trichosanthes cucumerina
			444	Mung bean	Phaseolus aureus
			445	Pigeon pea	Cajanus cajan
			449	Other bean	

3	food crops	g	450	CABBAGE	
			451	Hibiscus cabbage	Hibiscus manihot
			452	Kangkong	
			453	Chinese cabbage	Brassica chinensis
			454	English cabbage	Brassica compestis
			455	Watercress	
			459	Other cabbage	
3	food crops	h	460	VEGETABLE	
			461	Pumpkin	Cucurbita maxima
			462	Cucumber	Cucumis sativus
			463	Shallot	Allium spp.
			464	Onion	Allium cepa
			465	Tomato	Lycopersicon esculentum
			466	Okra	Hibiscus esculentus
			467	Egg plant	Solanum melongena
			468	Green pepper (sweet)	Capsicum annuum
			479	Other vegetable	
2	short term cash crops	i	500	SPICES	
			511	Chilli pepper	Capsicum spp.
			512	Pepper corn	Piper nigrum
			513	Turmeric	Curcuma domestica
			514	Cardamom	Ellettaria cardamomum
			515	Cinnamon	Cinnamomum zeylanicum
			516	Ginger	Zingiber officinale
			517	Garlic	Allium sativum
			518	Vanilla	Vanilla fragrans
			529	Other spice	
2/3	cash/food crops	j	600	FRUIT CROPS	
			611	Water melon	Citrullus lanatus
			612	Rock melon	
			613	Pineapple	Ananas comosus
			614	Paw Paw	Carica papaya
			615	Passion fruit	Passiflora edulus f. flavicarpa
			619	Other fruit crop	
1	tree crops	k	620	FRUIT TREES	
			621	Guava	Psidium guajava
			622	Mango	Mangifera indica
			623	Soursop	
			624	Local Apple	
			625	Malayan Apple	Eugenia malaccensis
			626	Avocado	Persea americana
			629	Other fruit tree	

3	food crops	l	630	BANANA	Musa spp.
			631	Cooking banana	
			632	Sweet banana	
			639	Other banana	
1	tree crops	m	640	CITRUS TREES	
			641	Orange	Citrus sinensis
			642	Lime	Citrus aurantifolia
			643	Grapefruit	Citrus paradisi
			644	Pomelo	Citrus grandis
			649	Other citrus	
1	tree crops	n	650	NUT TREES	
			651	Ngali Nut	Canarium spp.
			652	Cut Nut	Barringtonia spp.
			653	Betel Nut	Areca catechu
			654	Cashew Nut	Anacardium occidentale
			655	Alite Nut	Terminalia catappa
			659	Other Nut	
2	short term cash crops	o	660	SUGAR CANE	
			661	Sugar cane	Saccharum spp.
			662	Pit Pit	Saccharum edule
			669	Other	
1	tree crops	p	700	FOOD/BUILDING TREE	
			701	Breadfruit	Artocarpus altilis
			702	Sago palm	Metroxylon spp.
			703	Bamboo	Nastus spp.
			709	Other tree	
2	short term cash crops	q	800	Tobacco	Nicotiana tabacum

Annex: 2
LABOUR BUDGETS

A2.1 Sunmmaries of labour in the main body of the report are derived from labour budgets shown in tables A2.1 to A2.9, each covering a major land or crop operation:

Table	Operation
A2.1	Land Clearance
A2.2	Cultivation
A2.3	Planting
A2.4	Tree Crops Establishment
A2.5	Tree Crops Maintenance
A2.6	First Weeding
A2.7	Second Weeding
A2.8	Third Weeding
A2.9	Harvesting

A2.2 Each table is divided into two sub-tables, named "a" and "b". Part "a" expresses budgets in the form of labour per hectare. Part "b" converts these results to labour per holding, based on mean holding sizes previously derived.

A2.3 Tables in "part a" are divided into two main components. Part "i" expresses "labour input by main crop growing in the plot". This is the measured labour input from field data and is derived from a subsample of plot observations. To the left of the table is the main crop type, which is the dominant crop in a mixture. In the first column of the table is the number of plots on which observations were made, and in the second column is the mean area of observed plots. The third column summarises the average number of times per year that the operation is performed in a cropping sequence, and the fourth column expresses the average number of hours worked per day.

A2.4 Within the box are labour data expressed in terms of seasonal (single crop) and annual (crop sequence) labour input, broken down by men, women and paid labour. The wage cost of paid labour is shown in the right-most column. In this, hours are converted to days by dividing by the average number of hours worked per day. This then takes account of "unproductive" time such as for travel to and from the garden, and expresses labour in terms of actual time taken. It does not, however, take account of different agricultural operations which may take place on the same day for instance where a morning might be spent clearing a plot while the afternoon is spent in weeding. Commonly work is split between the cool hours of the morning and late afternoon and so such circumstances should not generally arise.

A2.5 Below is "part ii" of the table, in which the composition of labour input is shown in more detail. The first four columns show the average number of workers in each category. Within the box is a summary of the table above, in which the % contribution of men, women and paid labour is shown.

A2.6 "Part b" of the table is on the page following "part a", in which annual labour per hectare is converted to annual labour per holding based on mean holding areas recorded for each given crop and operation - since each sub-sample will differ from the others. These are shown in the upper part of the table in two forms, as work hours and as work days by category of labour. The annual wage labour cost is shown in the far right column of the table.

A2.7 Below is the labour budget expressed in terms of time per household labour unit. In this it is assumed that communal labour is reciprocated and so balances out. Total labour input may therefore be expressed simply in terms of family labour. Wage labour is external and is therefore given the adult equivalent "weighting" of 1. Family labour is weighted according to the age composition of the family, analysed in chapter 3.

A2.8 Each set of tables for an operation is accompanied by a diagram in which the annual days of labour per holding are summarised by crop and by labour category.

A2.9 Various points should be noted about the derivation of labour budgets:

i) They are expressed in the form of "models" which are based on a sub-sample of observations. These are derived from interview, not direct measurement, although care is taken to minimise recall periods. Labour budgets are built up from a mosaic of labour records.

ii) Crop categories are summaries of complex mixtures in which the crop listed is dominant. Labour data are thus compatible with cropping pattern data and represents actual field conditions. No attempt is made to restrict or control the conditions under observation.

iii) Each table shows the labour input for an operation which is conducted. The tables do not show the extent to which operations may be missed or combined. Such refinements are difficult to include without a more complex, and therefore more costly and time consuming, survey design. The analysis therefore tends to be conservative since it does not take account of possible economies in combined operations.

iv) Caution should be exercised in interpreting results from few observations since labour data on complex systems are very variable.

v) Labour, although of central importance in the agricultural economy, is not necessarily economically optimising. Often labour has an important social character in which households will group together and "share" labour. Differences in site and labour composition, together with the social character of some labour, introduce considerable variability into results.

Table: A2.1a
LABOUR OPERATIONS ON LAND CLEARANCE (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	Labour input: per season: hours/ha: men	Labour input: per season: hours/ha: women	Labour input: per season: hours/ha: paid	Labour input: per year: hours (hrs/ha)	Labour input: per year: days (d/ha)	Labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	120	0.355	1.05	5.7	493	316	16	866	152	4.67
Cleared land :	6	0.075	1.00	7.8	487	100		588	75	
Coconut :	13	2.141	1.00	3.6	156	62	40	259	72	7.84
Cocoa :	6	0.535	1.00	1.3	92		46	138	104	14.42
Sweet potato :	30	0.101	1.20	5.9	669	362	15	1256	214	8.29
Yam :	19	0.117	1.00	5.9	378	475	15	868	147	3.94
Pana :	44	0.128	1.00	6.4	582	345	9	937	146	3.38
Cassava :	2	0.391	1.00	6.5	387	713		1100	169	

	average number of workers: men	women	paid	total	% contribution: men	women	paid
ii) Labour composition							
All plots summary :	2.1	1.3	2.1	5.3	60	38	2
Cleared land :	1.7	0.2		1.8	83	17	
Coconut :	4.5	0.9	4.4	9.8	60	24	16
Cocoa :	0.7		7.3	8.0	66		34
Sweet potato :	2.1	0.9	2.0	5.0	64	35	1
Yam :	2.1	1.3	0.8	4.1	44	55	2
Pana :	1.8	1.2	1.8	4.8	62	37	1
Cassava :	1.0	1.5		2.5	35	65	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.1b
LABOUR OPERATIONS ON LAND CLEARANCE (per holding)

i) Total time worked

	mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost $IS
Total :	1.312	375	204	41	79	39	12	130	8
Cleared land :	0.014	7	1		1	0		1	
Coconut :	0.835	130	52	34	36	14	9	61	6
Cocoa :	0.061	6		3	1		2	3	1
Sweet potato :	0.107	36	46	2	16	8	0	23	1
Yam :	0.051	19	24	1	3	4	0	7	1
Pana :	1.212	183	73	2	19	11	0	31	1
Cassava :	0.309	3	6		1	1		2	
Other	0.023								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

Labour units available	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labour men	% contribution to family labour women
Total	240	118	41	50	23	7	68	32
Cleared land	4	1		1	0		82	17
Coconut	83	30	34	23	8	5	71	29
Cocoa	4		3	1		1	100	
Sweet potato	55	27	2	9	5	0	65	35
Yam	12	14	1	2	2	0	44	56
Pana	79	42	2	12	7	0	63	37
Cassava	2	4		0	1		35	65

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.2a
LABOUR OPERATIONS ON CULTIVATION (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: men (hours/ha)	labour input: per season: women (hours/ha)	labour input: per season: paid (hours/ha)	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	115	0.196	1.11	6.3	464	47	3	572	92	0.79
Cleared land :										
Coconut :	11	0.688	1.00	6.2	440		6	445	86	1.05
Cocoa :	5	0.625	1.00	6.4	130	56		186	29	
Sweet potato :	29	0.104	1.28	6.6	382	69	2	579	88	0.62
Yam :	22	0.114	1.05	6.6	542	25		593	90	
Pana :	46	0.133	1.09	6.1	524	56	6	637	105	1.32
Cassava :	2	0.091	1.00	7.5	353			353	47	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	6.3	0.3	0.7	7.3	90	9	1
Cleared land :							
Coconut :	6.7		1.5	8.2	99		1
Cocoa :	3.4	2.0		5.4	70	30	
Sweet potato :	3.6	0.1	0.7	4.4	84	15	1
Yam :	9.1	0.2		9.3	96	4	
Pana :	7.2	0.3	0.9	8.3	99	10	1
Cassava :	2.0			2.0	100		

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.2b
LABOUR OPERATIONS ON CULTIVATION (per holding)

i) Total time worked

	mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost (SIS)
Total :	1.312	580	27	6	105	4	1	110	1
Cleared land :	0.014								
Coconut :	0.835	367		5	71		1	72	1
Cocoa :	0.061	8	3		1	1		2	
Sweet potato :	0.107	52	9	0	8	1	0	9	0
Yam :	0.051	29	1		4	0		5	
Pana :	0.212	121	13	1	20	2	0	22	0
Cassava :	0.009	3			0			0	
Other	0.023								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labour men	% contribution to family labour women
Labour units available	1.56	1.73	1.00					
Total	372	16	6	67	2	1	96	4
Cleared land								
Coconut	235		5	45		1	100	
Cocoa	5	2		1	0		70	30
Sweet potato	33	5	0	5	1	0	85	15
Yam	19	1		3	0		96	4
Pana	77	7	1	13	1	0	90	10
Cassava	2			0			100	

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.3b
LABOUR OPERATIONS ON PLANTING (per holding)

i) Total time worked

	mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SI$)
Total :	1.312	127	224	6	26	36	1	64	1
Cleared land :	0.014								
Coconut :	0.835	108		4	23		1	24	1
Cocoa :	0.061	7	3		1	1		2	
Sweet potato :	0.107	8	58	0	1	9	0	10	0
Yam :	0.051	1	22		0	3		3	
Pana :	0.212	3	140	1	0	23	0	24	0
Cassava :	0.009	1	2		0	0		0	
Other	0.023								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	1.56	1.73	1.00					
Total	81	130	6	17	21	1	36	64
Cleared land								
Coconut	69		4	15		1	100	
Cocoa	4	2		1	0		70	30
Sweet potato	5	33	0	1	5	0	12	88
Yam	0	12		0	2		3	97
Pana	2	81	1	0	13	0	2	98
Cassava	0	1		0	0		26	74

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.4a
LABOUR OPERATIONS ON TREE CROPS ESTABLISHMENT (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season, men (hours/ha)	labour input: per season, women (hours/ha)	labour input: per season, paid (hrs/ha)	labour input: per year, hours (hrs/ha)	labour input: per year, days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	10	0.339	1.10	4.9	127	28	3	173	35	0.36
Cleared land :										
Coconut :	5	0.359	1.00	4.6	129		5	134	29	1.32
Cocoa :	5	0.319	1.20	5.2	125	56		217	42	
Sweet potato :										
Yam :										
Pana :										
Cassava :										

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	2.0	1.0	0.5	3.5	81	18	2
Cleared land :							
Coconut :	1.0		1.0	2.0	96		4
Cocoa :	3.0	2.0		5.0	69	31	
Sweet potato :							
Yam :							
Pana :							
Cassava :							

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.4b
LABOUR OPERATIONS ON TREE CROPS ESTABLISHMENT (per holding)

i) Total time worked

	mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost (SIS)
Total :	1.313	117	4	4	25	1	1	27	1
Cleared land :	0.014								
Coconut :	0.835	108		4	23		1	24	1
Cocoa :	0.061	9	4		2	1		3	
Sweet potato :	0.107								
Yam :	0.051								
Pana :	0.212								
Cassava :	0.009								
Other	0.023								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labour men	% contribution to family labour women
Labour units available	1.56	1.73	1.00					
Total	75	2	4	16	0	1	97	3
Cleared land								
Coconut	69		4	15		1	100	
Cocoa	6	2		1	0		69	31
Sweet potato								
Yam								
Pana								
Cassava								

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.3a
LABOUR OPERATIONS ON PLANTING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours /ha	labour input: per year: days /ha	labour cost $/ha/yr
i) Labour input by main crop growing in the plot										
All plots summary :	117	0.366	1.15	6.1	43	393	3	509	33	0.79
Cleared land :										
Coconut :	13	0.141	1.00	4.7	130		5	134	29	0.99
Cocoa :	6	0.535	1.30	6.7	108	47		155	27	
Sweet potato :	29	0.103	1.28	6.4	60	423	2	620	97	0.62
Yam :	23	0.114	1.34	6.6	11	404		434	66	
Pana :	43	0.135	1.19	6.0	19	557	6	679	113	1.54
Cassava :	3	0.116	1.00	7.3	85	243		328	45	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.8	5.2	0.6	6.6	10	90	1
Cleared land :							
Coconut :	4.5		1.2	5.8	96		4
Cocoa :	2.7	1.7		4.3	70	30	
Sweet potato :	0.4	3.3	0.7	4.4	12	87	0
Yam :	0.1	7.4		7.5	3	97	
Pana :	0.1	7.5	0.9	8.5	2	97	1
Cassava :	1.0	1.3		2.3	26	74	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.5a
LABOUR OPERATIONS ON CROP MAINTENANCE (per hectare)

	number of plots	mean plot size (ha)	operation times per year	average hours worked per day	labour input: per season men (hours/ha)	labour input: per season women (hours/ha)	labour input: per season paid (hours/ha)	labour input: per year hours/ha	labour input: per year days/ha	labour cost
i) Labour input by main crop growing in the plot										
All plots summary	13	0.484	1.85	4.8	92		2	174	37	0.73
Cleared land										
Coconut	7	0.523	1.00	4.1	96		4	100	24	0.73
Cocoa	5	0.318	2.20	6.0	105			220	38	
Pineapple	1	1.044	6.00	3.0	3			17	6	

	average number of workers: men	women	paid	total	% contribution: men	women	paid
ii) Labour composition							
All plots summary	1.9	0.1	0.4	2.4	98		2
Cleared land							
Coconut	1.3	0.1	0.7	2.1	96		4
Cocoa	3.0			3.0	100		
Pineapple	1.0			1.0	100		

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.5b
LABOUR OPERATIONS ON CROP MAINTENANCE (per holding)

i) Total time worked

		mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost (SIS)
Total	:	1.312	95		3	22		1	23	1
Cleared land	:	0.014								
Coconut	:	0.835	81		3	19		1	20	1
Cocoa	:	0.061	14			2			2	
Pineapple	:	0.019	0			0			0	
	:									
	:									
	:									
		0.383								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labour men	% contribution to family labour women
Labour units available	1.56	1.73	1.00					
Total	61		3	14		0	100	
Cleared land								
Coconut	52		3	12		0	100	
Cocoa	9			2			100	
Pineapple	0			0			100	

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.6a
LABOUR OPERATIONS ON FIRST WEEDING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	95	0.445	1.26	6.0	54	329	1	436	81	3.59
Cleared land :										
Coconut :	17	1.800	1.00	4.6	76	16	4	96	21	2.60
Cocoa :	3	0.589	1.00	4.7	100	121		221	47	
Sweet potato :	27	0.107	1.37	5.9	53	355		553	95	
Yam :	13	0.111	1.23	6.2	46	327		459	74	
Pana :	32	0.165	1.38	6.8	47	513		770	114	
Cassava :	3	0.116	1.00	7.3	21	136		156	21	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.5	1.9	0.4	2.7	14	86	0
Cleared land :							
Coconut :	1.4	0.6	2.1	4.1	79	17	4
Cocoa :	1.7	2.0		3.7	45	55	
Sweet potato :	0.3	2.2		2.5	13	87	
Yam :	0.3	2.2		2.5	12	88	
Pana :	0.1	2.3		2.3	8	92	
Cassava :	0.3	1.3		1.7	13	87	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.6b
LABOUR OPERATIONS ON FIRST WEEDING (per holding)

i) Total time worked

	mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost (SI$)
Total :	1.312	94	244	3	19	39	1	59	2
Cleared land :	0.014								
Coconut :	0.835	64	13	3	14	3	1	18	2
Cocoa :	0.061	6	7		1	2		3	
Sweet potato :	0.107	8	52		1	9		10	
Yam :	0.051	3	21		0	3		4	
Pana :	0.212	14	150		2	22		24	
Cassava :	0.009	0	1		0	0		0	
Other	0.023								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labour men	% contribution to family labour women
Labour units available	1.56	1.73	1.00					
Total	60	141	3	12	22	0	28	72
Cleared land								
Coconut	41	8	3	9	2	0	83	17
Cocoa	4	4		1	1		45	55
Sweet potato	5	30		1	5		13	87
Yam	2	12		0	2		12	88
Pana	9	86		1	13		8	92
Cassava	0	1		0	0		13	87

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.7a
LABOUR OPERATIONS ON SECOND WEEDING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: men (hours/ha)	labour input: women (hours/ha)	labour input: paid (hours/ha)	labour input per year: hours (hrs/ha)	labour input per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	56	0.607	1.29	5.1	40	161	1	260	51	0.97
Cleared land :										
Coconut :	14	2.023	0.93	3.7	59	5	5	64	17	3.81
Cocoa :	1	0.091	1.00	7.3	77			77	11	
Sweet potato :	22	0.101	1.41	4.9	32	189		312	64	
Yam :	5	0.136	1.20	5.2	3	258		312	60	
Pana :	13	0.196	1.54	6.6	41	265		472	71	
Cassava :	1	0.129	1.00	8.3	62	62		124	16	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.6	1.5	0.5	2.7	20	30	1
Cleared land :							
Coconut :	1.6	0.5	2.1	4.3	86	8	7
Cocoa :	1.0			1.0	100		
Sweet potato :	0.3	1.9		2.2	15	85	
Yam :	0.2	2.4		2.6	1	99	
Pana :	0.2	1.8		2.0	14	86	
Cassava :	1.0	1.0		2.0	50	50	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.7b

LABOUR OPERATIONS ON SECOND WEEDING (per holding)

i) Total time worked

		mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SIS)
Total	:	1.312	70	136	4	16	23	1	40	2
Cleared land	:	0.014								
Coconut	:	0.835	46	4	4	12	1	1	14	2
Cocoa	:	0.061	3			1			1	
Sweet potato	:	0.107	5	28		1	6		7	
Yam	:	0.051	0	16		0	3		3	
Pana	:	0.212	14	87		2	13		15	
Cassava	:	0.009	1	1		0	0		0	
Other		0.023								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	1.56	1.73	1.00					
Total	45	78	4	10	13	1	34	66
Cleared land								
Coconut	30	2	4	8	1	1	92	8
Cocoa	3			0			100	
Sweet potato	3	16		1	3		15	85
Yam	0	9		0	2		1	99
Pana	9	50		1	8		14	86
Cassava	0	0		0	0		50	50

Derived from household composition labour availability

% contribution to family labour is derived from the table above

Table: A2.8a
LABOUR OPERATIONS ON THIRD WEEDING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	31	0.296	1.35	5.0	44	135		243	48	
Cleared land :										
Coconut :	9	0.678	1.00	4.1	50	8		58	14	
Cocoa :	1	0.091	1.00	7.0	77			77	11	
Sweet potato :	13	0.116	1.54	4.9	22	119		218	44	
Yam :	2	0.143	1.00	4.0		197		197	49	
Pana :	5	0.212	1.80	6.4	99	423		940	147	
Cassava :	1	0.129	1.00	8.0	62	62		124	16	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	2.3	1.3		3.1	73	42	
Cleared land :							
Coconut :	1.9	0.8		2.7	87	13	
Cocoa :	1.0			1.0	100		
Sweet potato :	0.3	1.7		2.0	16	84	
Yam :		2.5		2.5		100	
Pana :	0.2	2.4		2.6	19	81	
Cassava :	1.0	1.0		2.0	50	50	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.8b
LABOUR OPERATIONS ON THIRD WEEDING (per holding)

i) Total time worked

	mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SI$)
Total :	1.312	89	198		18	33		51	
Cleared land :	0.014								
Coconut :	0.835	42	6		10	2		12	
Cocoa :	0.061	5			1			1	
Sweet potato :	0.107	4	20		1	4		5	
Yam :	0.051		10			3		3	
Pana :	0.212	38	162		6	25		31	
Cassava :	0.009	1	1		0	0		0	
Other	0.023								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	1.56	1.73	1.00					
Total	57	115		11	19		31	69
Cleared land								
Coconut	27	4		7	1		87	13
Cocoa	3			0			100	
Sweet potato	2	11		0	2		16	84
Yam		6			1			100
Pana	24	93		4	15		19	81
Cassava	0	0		0	0		50	50

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.9a
LABOUR OPERATIONS ON HARVESTING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	71	0.503	2.70	3.0	12	184		530	177	
Cleared land :										
Coconut :	11	2.339	2.82	6.4	44	42		244	38	
Cocoa :	3	0.677	1.67	5.7	31	47		131	23	
Pineapple :	1	1.044	9.00	5.0	5			43	9	
Sweet potato :	30	0.109	3.43	1.8	4	152		537	304	
Yam :	7	0.138	1.00	1.7	8	120		128	75	
Pana :	18	0.144	1.89	2.9	5	389		744	257	
Cassava :	1	0.129	3.00	3.0	23	23		140	47	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.5	1.9		2.4	6	94	
Cleared land :							
Coconut :	1.4	1.4		2.7	51	49	
Cocoa :	2.0	3.3		5.3	40	60	
Pineapple :	1.0			1.0	100		
Sweet potato :	0.2	2.0		2.2	3	97	
Yam :	0.6	1.6		2.1	6	94	
Pana :	0.1	2.2		2.3	1	99	
Cassava :	1.0	1.0		2.0	50	50	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

Table: A2.9b
LABOUR OPERATIONS ON HARVESTING (per holding)

i) Total time worked

		mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost (SI$)
Total	:	1.312	112	323		19	106		125	
Cleared land	:	0.014								
Coconut	:	0.835	104	100		16	16		32	
Cocoa	:	0.061	3	5		1	1		1	
Pineapple	:	0.019	1			0			0	
Sweet potato	:	0.107	2	56		1	32		33	
Yam	:	0.051	0	6		0	4		4	
Pana	:	0.212	2	156		1	54		55	
Cassava	:	0.009	1	1		0	0		0	
Other		0.004								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labour men	% contribution to family labour women
Labour units available	1.56	1.73	1.00					
Total	72	187		12	61		26	74
Cleared land								
Coconut	67	58		10	9		51	49
Cocoa	2	3		0	0		40	60
Pineapple	1			0			100	
Sweet potato	1	32		1	18		3	97
Yam	0	4		0	2		6	94
Pana	1	90		0	31		1	99
Cassava	0	0		0	0		50	50

Derived from household composition labour availability
% contribution to family labour is derived from the table above

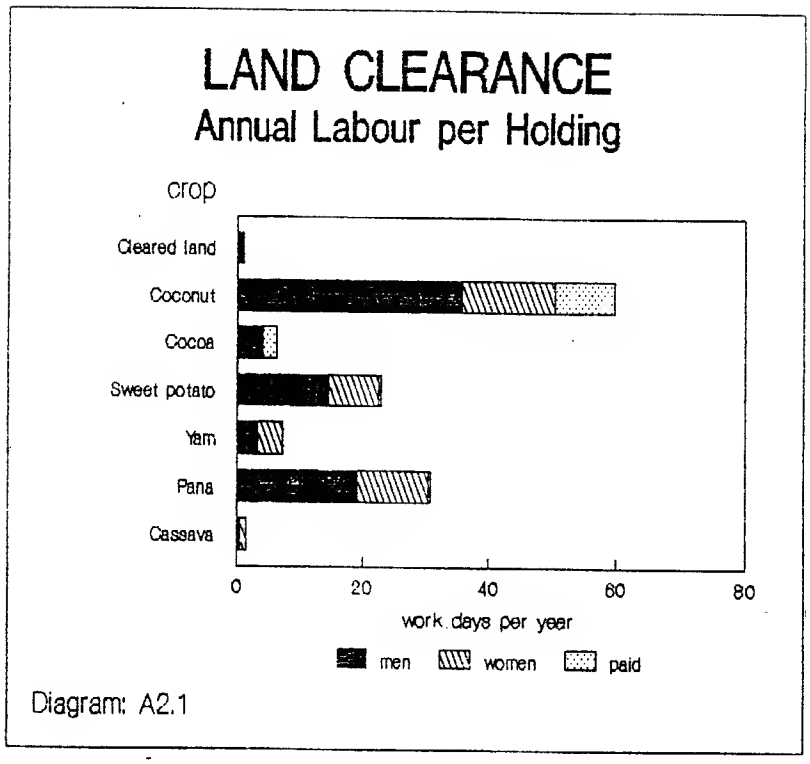


Diagram: A2.1

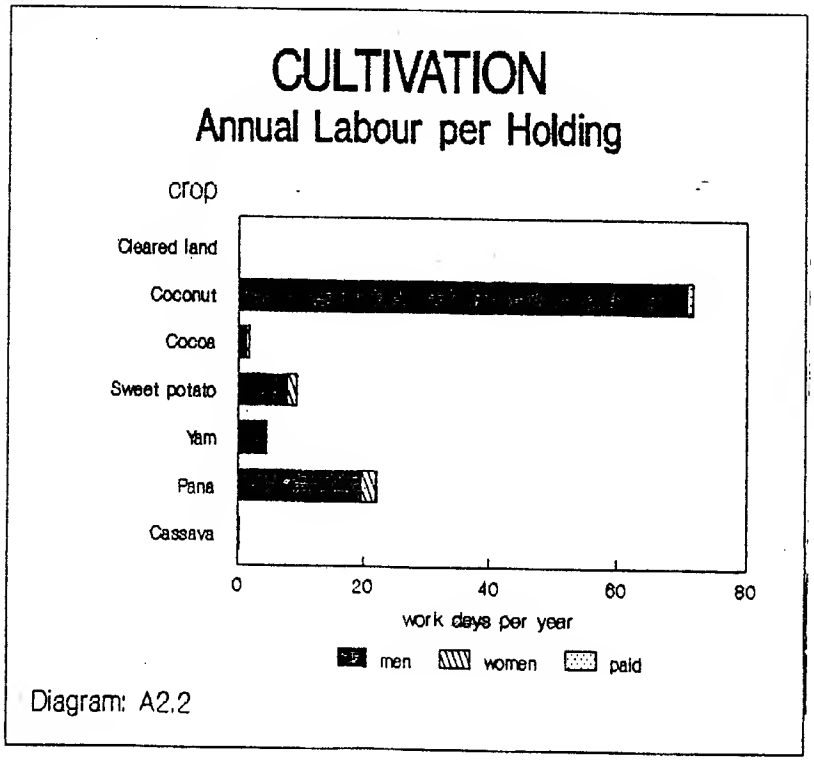


Diagram: A2.2

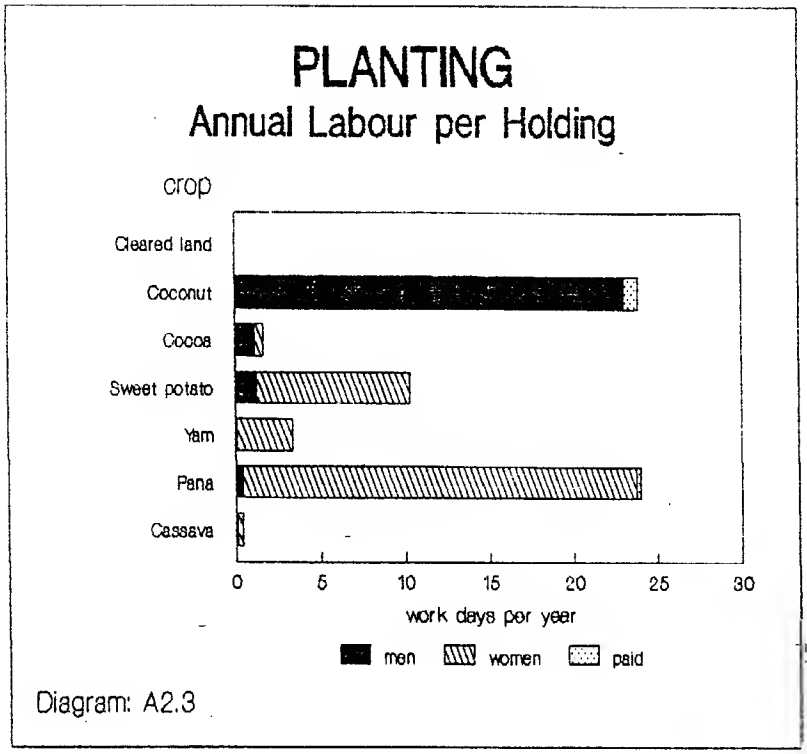


Diagram: A2.3

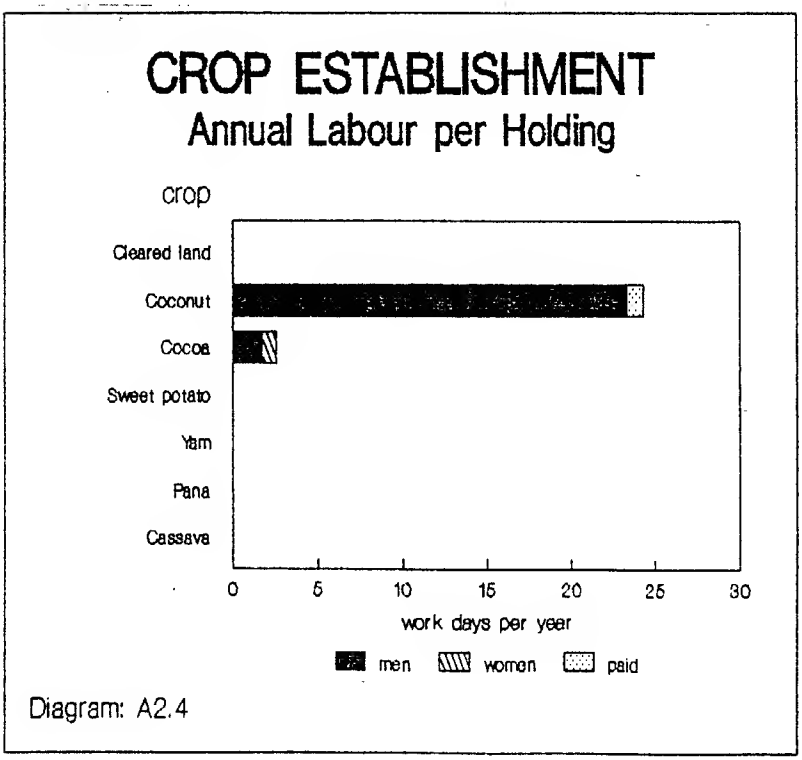


Diagram: A2.4

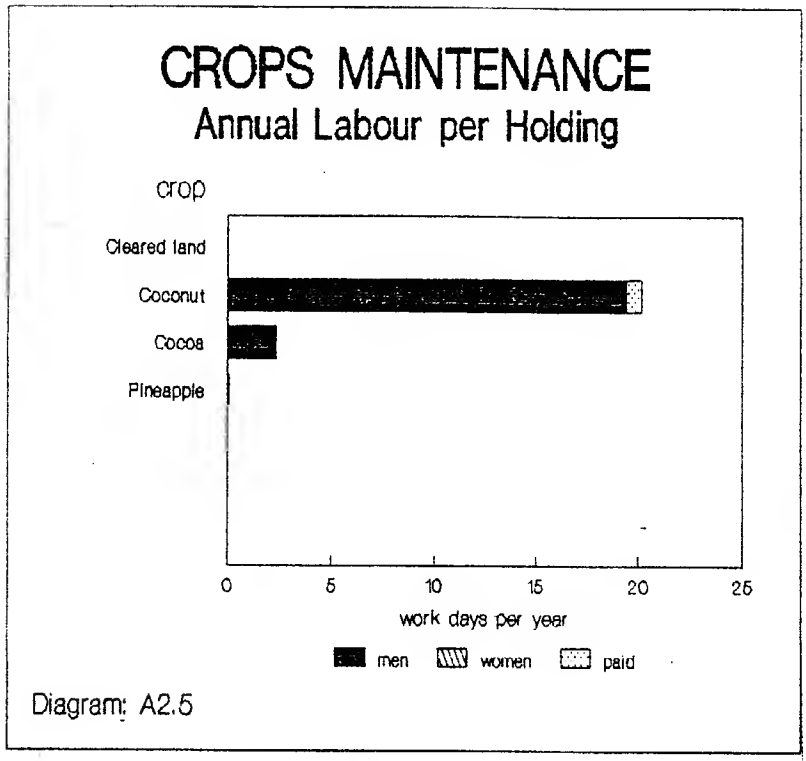


Diagram: A2.5

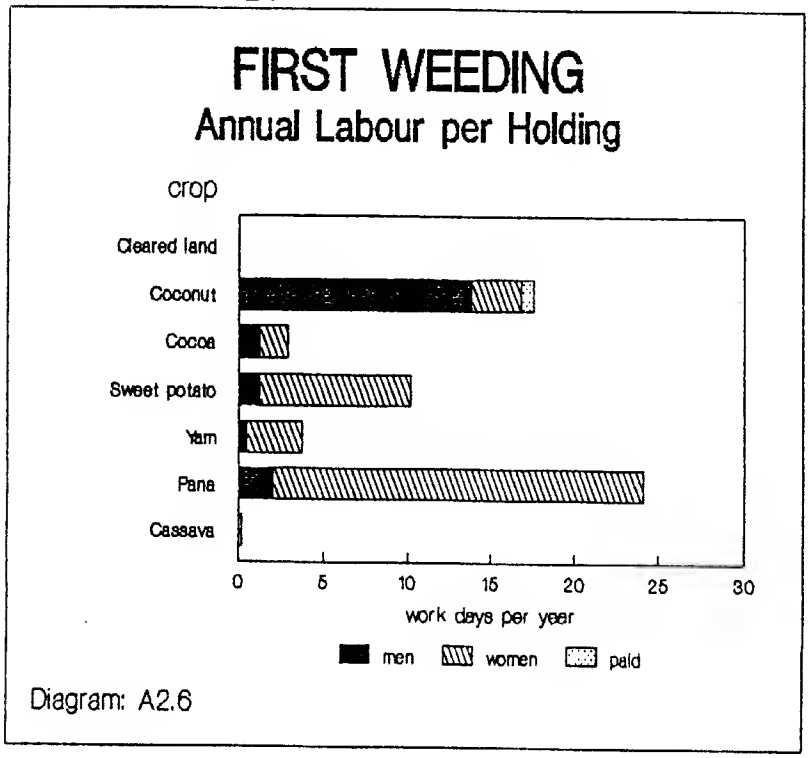


Diagram: A2.6

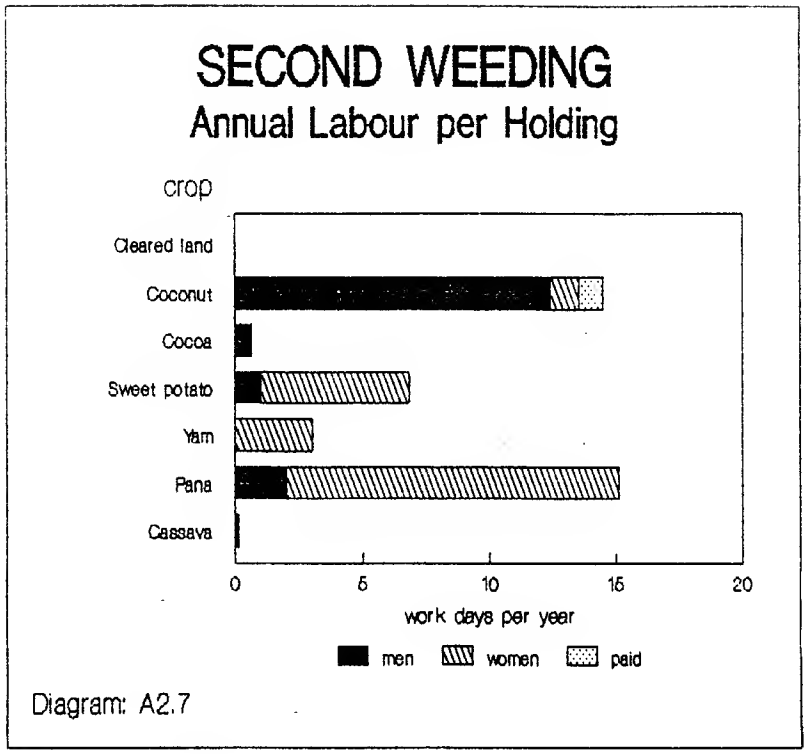


Diagram: A2.7

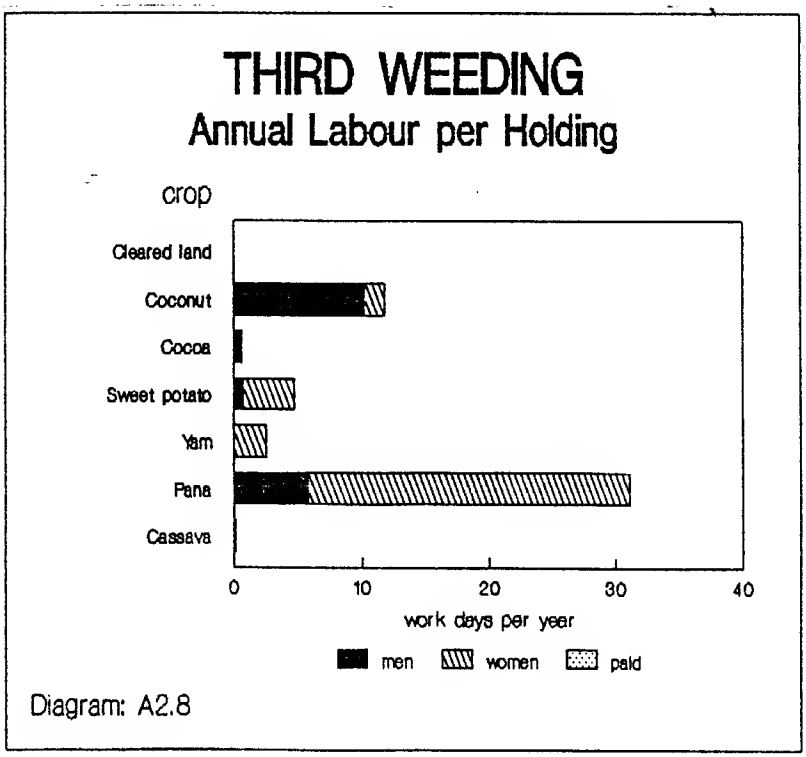


Diagram: A2.8

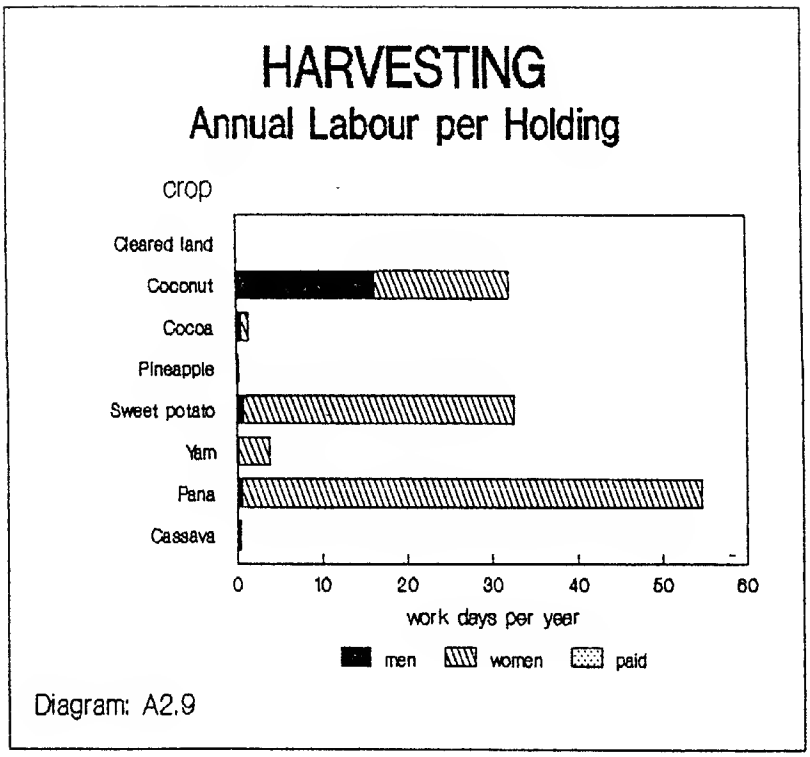

HARVESTING
Annual Labour per Holding
crop
Cleared land
Coconut
Cocoa
Pineapple
Sweet potato
Yam
Pana
Cassava
0
10
20
30
40
50
60
work days per year
men
women
paid

Diagram: A2.9

Annex: 3
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